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魚・雜
J. J. I.

魚　の　會

魚　の　會

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アユ卵の形態と二三の性質

狩野康比古
(北海道大學理學部動物學教室)

Über das Ei und einige seiner Charakteristika bei einem japanischen Knochenfisch, Ayu (*Plecoglossus altivelis*)

Yasuhiko KANOH
(Zool. Inst. Hokkaido Univ., Sapporo)

アユ (*Plecoglossus altivelis*) は本邦各地に棲息する有用淡水魚であつて盛んに孵化增殖が試みられているが、生物學上からも其の形態、生活史等かなり特異な点を有しているので之等に關する報告も多く、從つて卵の形態、性質に就いても觀察記載されている。しかし、廣く魚卵の受精、活性化の比較檢討の材料としてみると、この卵に關しては何等知り得べき資料も無く、諸氏の觀察記載に依ると單にこの卵は沈性附着卵に屬し、附着の場合も二重の卵膜の中の最外膜が裂けて反轉、附着器となると考へられているに過ぎ無い。處がこの場合も附着後の狀態を見ると、附着器は柸狀を呈し、遊離緣以外に裂目が無い。從つてもし從來から考へられている様に、完全な二重卵膜の中の外膜が反轉して柸狀の附着器となるとすると、反轉の際には一旦多くの經の裂目が出來て割れて反轉、附着後之が閉ぢるか、一箇所のみで裂けて反轉する時は膜の廣範圍な伸縮があらねばならない。いづれにしてもかなり巧妙な反轉附着機構を要する筈である。

魚卵の附着に就いてはかつてニシン卵、カレイ卵に就いて報告したが (狩野、'50)、アユ卵に於て上記疑問が生じたので、受精、活性化の檢討と共に、前提的に其の形態、附着法を調べてみた。

實驗觀察の便宜は全て北海道區水產研究所に依り與へられ、就中、同研究所佐藤榮技官及び余市川のアユ孵化場、余市漁業會囑託丸井勘三郎氏の並々ならぬ御厚意を受けた。記して感謝したい。又九大農學部內田惠太郎教授より同教授未發表のアユ卵其の他の各種魚卵の貴重なる觀察圖を拜見さして頂き、本稿起草に參照し得た事を心から御禮申し上げ度い。尙實驗に際しては當時北大理學部學生、伊東鎭雄、同柳町隆造兩君の助力を得、又其の費用の一部は文部省科學研究費を使用した事も記して謝意を表する。

材料及び方法

親魚は全て北海道後志國余市川に9月中旬產卵來游したものを用ひた。北海道のアユは、明治初頭本土より移殖したものとも云はれるが詳らかな記錄は不明である。1) しかし、現在ではかなり多數棲息する様で、來游期には釣人で賑はひ、又余市漁業會では親魚を捕獲し採卵、孵化放流を行つている。

實驗觀察に供した卵は生の親魚より直接紋り出した成熟卵で、何れも高い受精率を示すものであつた。水道水以外の媒液は予め $NaHCO_3$ で中性となした蒸溜水で調製し、リンゲル液の組成は 1MNacl 100+1MKCl 2.8+2/3M$CaCl_2$ 3.4 となし、之を 1M リンゲル液と名付けた。

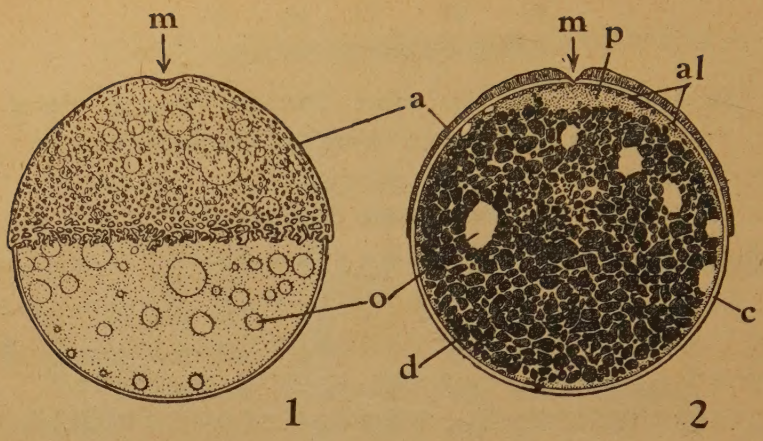
觀察及び寫眞撮影は大部分生のままで行つたが固定の際はギルソン液を用ひ、通常のパラフイン法で切片となし、デラフイールド・ヘマトキシリン及びエオシンで染色檢鏡した。

1. 形　　態 2)

未受精成熟卵は淡黃色、圓形を呈し、卵徑は 0.8—1.0mm, 厚さ 7μ 前後の密着した一層の透

1) 移殖に依らず、從來より棲息しているものと考へている人も多い。

2) チカ (*Hypomesus japonicus*) の卵の形態特に其の附着膜もアユ卵と殆んど同樣である事を最近知つた。



Textabb. 1 未受精成熟卵 60倍
1 全体圖 2 動物極を通る切斷圖
a. 附着膜, al. 表層胞, c. 卵膜, d. 卵黄粒, m. 卵門, o. 油球, p. 卵細胞質

Textabb 1. Schematische Darstellung des Reifeies. ca 60 X
1 Oberansicht 2 Querschnitt
a Anklebemembran al Kortikalalveoli c Eimembran d Dotterkörnchen
m Mikropyle o Oeltropfen p Ooplasma

明卵膜で被れているが、其の一部に濾斗狀の卵門が有る。又この卵門のある半球、即ち動物半球にはさきの卵膜より尙厚い所謂附着膜が覆さり、之は卵門部で卵膜に連なつている (Fig. 1, 2)。從つて附着膜自身は半球狀で其の遊離緣はほぼ卵表面の赤道部に位置しているが、この部は複離に屈曲した形狀を呈している(圖版參照)。卵膜表面には極めて細かい無數の窪みがあり、又附着膜には 2μ 前後の不規則な穴が開いているが低倍率で檢鏡すると附着膜で覆れた部分は稍々不透明になつているので容易に識別する事が出來る(圖版參照)。尙、附着膜は卵門部で厚く、遊離緣に行くに從つて次第に薄くなる (22μ-17μ)。

卵体は他の魚卵と同樣に大部分卵黄と卵細胞質からなり、內に大小油球 (10μ-180μ)) を含む。卵細胞質は概ね表層細胞質として位置し、之は卵門部で多少厚くなつている。この部が胚盤となる部域である。表層細胞質中には無數の所謂表層胞があり、大きさは 22-45μ. 油球とは屈折率の相異で區別し得るが生のままでは稍々見難い時もある。

以上述べた事は切片にて尙良く確かめる事が出來たが (Fig. 2 及び圖版)、この際固定のため附着膜は膨潤し波狀に盛上つている。生の時の觀察結果から判斷すると實際は第2圖の如きものと考へられる。

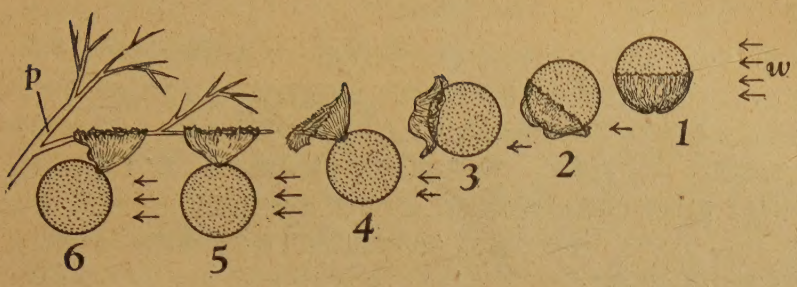
卵門は濾斗狀で、この部の卵膜は內部に突出し、一見ニシン卵の卵門部に似るが (狩野 49′) 染色性は他の部と余り變らない。

2. 附 着 法

卵は水より重く、沈性附着卵に屬し、上記附着膜が剝離反轉して附着器となる。

附着膜は極めて剝離し易く又其の表面は粘着性があるので他物に觸れるとすぐ粘着する。

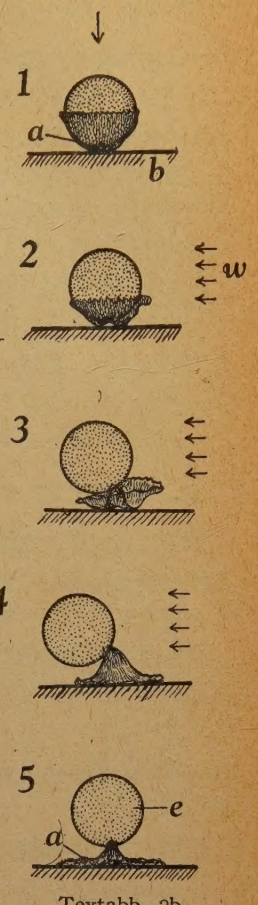
卵を靜置すれば附着膜はもとのままで剝離する事は無いが、其の場所に粘着し附着するので其の後水流等を受け動搖すると中の卵のみが離れ、附着膜は殘つて剝離反轉し卵門部で連結、卵を保持する事となる。後で述べる樣にこの卵は受精、未受精に拘はり無く水に接すると直ちに活性化



Textabb. 2a

Textabb. 2　卵の附着過程の二例、數字は順序を示す。
a 附着膜　b 水底　e 卵体　w 水流　p 水藻

Textabb. 2. Zweierleie Beispiele des Anklebeprozesses des Eies
a Anklebemembran　*b* Grund des Wassers　*e* Eileib
w Wasserströmung　*p* Wasserpflanze
Ziffern zeigen die Reihenfolge des Prozesses.



Textabb. 2b

し圍卵腔が形成され卵膜が扛擧するので附着膜の剝離にこの現象が原因する様に考へられるが、實際には無關係で、剝離するためには極めて輕くて充分ではあるが他の機械的干涉を必要とする。從つてもし卵を靜かに取出し水中に靜止して置くと附着膜剝離無しに活性化し、發生も又進行する事が出來る。又附着前、即ち水中を落下する途中でも水流等で適當な動搖を卵が受けると附着膜は剝離反轉し其の後他物に粘着附着するわけである。挿圖（2a 及び b）は夫々附着前及び附着後附着膜の剝離反轉する二通りの附着過程を示したもので附圖（圖版 II7）は一旦器底に沈下粘着したものに水流を與へ卵が分離して附着膜が剝離反轉したものを側面より撮影したもの、及び沈下途中硝子糸に粘着、附着膜が剝離反轉し之にからみついた同一卵を夫々側面から撮影したもので（圖版II6,6′）何れも活性化している。

附着膜の遊離緣が複雜に屈曲した形狀を呈しているのでこの部は剝離後他物にからみつき易く、このためより强固な附着性が生づると考へられる。

自然狀態に於てはアユはかなり水流のはげしい處で產卵するので產みだされた卵が初め粘着するとしても、絕えず水の動搖を受けるため直ちに中の卵が附着膜から分離し、附着膜の反轉を起すであらう。又親魚自身活潑に運動し激しく放卵するので粘着前に剝離反轉する事も多く、この際は其の後他物にからみつき附着する事とならう。

要するにこの卵の附着膜剝離反轉には機械的干涉が必要であり、且又附着膜は完全に卵全体を覆ふ膜では無く、3）始めより半球狀（柾狀）である上に、かなり柔軟であり、且つ多くの穴が有るから力學的に見ても反轉する事は容易である様に思はれる。從つてこの際さして廣範圍な無理な伸縮も必要では無く、この点極めて有利な形態、性質を有していると考へられる。

尙、この附着膜剝離反轉は媒液の鹽濃度等に關係無く、M/3.5–M/100 リンゲル液中でも、又蒸溜水中でも靜止すれば剝離する事なく、動搖を受けて始めて剝離反轉する。又附着膜の明らかな膨潤も上記濃度のリンゲル液中では認められなかつたし、蒸溜水及び非電解質であるグルコース液中でも膨潤する事は無かつた。一方、各液中で附着膜の固化の現象も起らず、外表面の粘着性も失はれ無いため一旦粘着附着したものを剝がしても又再び粘着する事が出來る。

3. 受精過程

アユ卵の發生に就いては既に小林（'23）の記載が有るので受精過程のみを簡單に述べる。

卵門より精子が進入すると、先づ最初に表層胞の崩潰が動物極より植物極へと波狀に進行する。之につれて卵膜が扛擧し始め遂に全卵周に及び圍卵腔が形成される。この際卵体自身も僅かに縮少する様であるが直徑に於て卵膜は約 12% 扛擧し、 30 分後にほぼ平衡に達する（21° C)。表層胞崩潰後所謂二極性分化が進行し、動物極に卵細胞質が集積し始め、盛上つた胚盤が生づるが、之と共に油狀は次第に數を減じ一つ一つが大きくなつて來る。次いで起る第1卵割は媒精後3時間目頃に始まり 16 時間で胞胚期に達する（21-22° C)。

尙、卵門部は卵の附着位置に從つて任意の場所にくる事となるが盛上つた胚盤もこの位置に照應して形成され、卵体が特に一定位置に廻轉する事は無い。少くとも初めの中は元の位置のまま卵膜中に浮び、其のままの位置で發生は進行する様である(圖版参照)。

今迄二重卵膜として記載されたのは動物極側からの觀察のみに基づいた爲であらう。

4. 無精的活性化

精子無しに卵を水道水中に移して見た處正常受精の際と殆んど同様な形態變化、即ち表層胞崩潰、卵膜扛擧（圍卵腔の形成）、二極性分化が進行し遂に盛上つた胚盤が形成された。この時期迄は殆んど正常受精の際と同じ速度で進みこの後胚盤にはしばしば卵割様の窪みが出來るが眞の卵割は行はれ無く丁度卵割前の狀態に止まる。しかし、以上の變化より之は卵が處女的に活性化したものと見做す事が出來る（圖版II6, 6′ 及び 7)。即ち、この卵は單に淡水に接するのみでも活性化し得ると考へられ、この点サケ卵と非常に類似した性質を有す様に思はれるがサケ卵の活性化は等調塩類溶液が抑制し、非電解質はこの作用が無い事が知られているので（狩野 50, 51）次に之等の点を確めて見た。

（1） リンゲル液の場合

この卵は M/7 附近が等調と考へられるので M/3.5, M/7, M/14, M/28, M/100 リンゲル液を用ひた。精子無しに各液に入れて見ると、 M/28 以下では殆んど水道水の場合と變り無い程度に活性化が進行し盛上つた胚盤が出來るが M/14 では2時間經過しても圍卵腔は狹く、胚盤の盛上りも弱い。 M/7 では余り變化無く、1時間目頃より漸く非常に狹い圍卵腔が認められる様になるが細胞質の集積は顯著で無い。 M/3.5 中でも矢張り非常に狹い圍卵腔が認められる様になるものもあるが夫れ以上の變化は起らないで間も無く細胞崩潰過程が起き死滅する。

要するにアユ卵では塩類溶液でも完全に活性化を抑制する濃度は無いが濃度大になるにつれ活性化の遲延が起きる。

サケ卵は淡水中では短時間の中に受精力を失ふが等調塩類溶液では長時間受精力を保持する。アユ卵を水道水及び M/7 リンゲル液に予め一定時間浸けた後媒精して受精力を調べて見ると（卵割したものを受精したものと見做す）、水道水中では5分以内に完全に受精力を失ふが M/7 リンゲル液では 20 分迄受精し得るものがある（21° C)。即ちこの場合もサケ卵と同様に等調塩類溶液が受精力保持に有効ではあるが、サケ卵に對する程顯著では無い。この事は、等調に於てもアユ卵の活性化がサケ卵の夫れと異なり完全に抑制されぬと云ふ事と關連ある様ではあるが、之等の差異が如何なる点に基づくかは尙今後に殘された問題である。

（2） 非電解質の場合

非電解質としてはグルコースを用ひ、この M/3.5 及び M/7 溶液について調べて見た。夫れに

3) 今迄、二重卵膜として記載されたものは動物極側からの觀察のみに基づいた爲であろう。

依ると、両液とも水道水と全く同様に速やかに活性化を起した。即ち非電解質の場合には濃度に關係無く活性化は進行すると推察される。

(3) カルシユーム缺除の場合

メダカ卵の表層胞崩潰には媒液中のカルシユームの存在を必要とし、之を缺く時は崩潰しない(山本 '44)。この点海産魚であるニシン卵も全く同様ではあるが(柳町、未發表)サケ卵ではカルシユームが無くとも表層胞は潰潰し、活性化は進行する(狩野 '51)。アユ卵をカルシユーム缺除等調リンゲル液或は蓚酸ソーダー溶液で洗滌しても之を蒸溜水又は M/100 カルシユーム缺除リンゲル液に戻すと速やかに活性化する。即ちアユ卵もサケ卵と同様に活性化に媒液中のカルシユームを必要としない。

以上、アユ卵の無精的活性化に關する二三の性質から見ると、かなりサケ卵と類似した点を有すると考へられるが、より詳しい考察は尙今後の實驗を經て始めて下し得るものであらう。

要　　約

1. アユ (*Plecoglossus altivelis*) の卵の形態、附着法及び受精、活性化に關する性質を調べた。

2. 卵は徑 1.0mm 前後、一層の卵膜に包まれているが、その外側半分、即ち動物半球外側には尙一層の所謂附着膜が覆さり、之は卵門部で卵膜に連なる。

3. 附着膜には無數の穴があり、遊離緣は複雜に屈曲している。又其の表面は粘着性である。

4. 附着膜は剝離し易く、剝離反轉して卵の附着器となるのであるが、之には必づ水流等機械的干涉を要し、受精又は活性化とは無關係に起る。

5. 附着過程は二通り考へられる。即ち、附着膜が剝離反轉した後他物に粘着からみつくか、粘着後中の卵が離れて附着膜が剝離反轉するかである。

6. 卵内には油球の他に所謂表層胞と呼ばれるべきものがある。正常受精の際には先づ表層胞が崩潰、二極分化し圍卵腔形成、次いで胚盤が隆起し、其の後卵割が始まる。

7. 卵は單に水に接するのみで表層胞崩潰、圍卵腔形成、胚盤の隆起を起す。從つて之は卵が無精的に活性化したと考へる。

8. 依つて、斯の如き活性化に對する媒液の影響、即ち電解質、非電解質及び Ca の影響を調べ、其の性質のサケ卵との類似性に言及した。

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附 圖 說 明

a. 附着膜 c. 卵膜 d. 卵黄粒 m. 卵門 p. 卵細胞質

Tafel I 及び II

1 未受精成熟卵、附着膜で覆れた半球は少しく不透明である。35倍

1′ 1 圖の卵の略圖

2 卵門部を通る切斷面、(固定材料)、ヘマトキシリン及びエオシン染色、100倍 固定の爲附着膜膨潤、Textabb. 1 參照。

3 卵門部切片、(固定材料)、700倍。

4 剝離した附着膜の一部、300倍。遊離緣の形狀及び穴を見よ。

5 未受精成熟卵の表面の一部、5′圖の矩形の部分の拡大で、附着膜の遊離緣が見られる。300倍

6 及び 6′ 水中で懸つた卵、側面より撮影、水温 21°C. 65倍。

6 水中に入れて 30 分後。

6′ 同 2 時間後。

7 水底に附着した卵、40倍、側面より撮影。

Zusammenfassung

Plecoglossus altivelis ist ein anadromischer Fisch, der im Frühling in den Oberlauf der Flüsse aufsteigt und im Herbst im Unterlauf derselben laicht. Gewöhnlich schlüpft die Brut in 10–20 Tagen aus, und sie wächst in einem Jahr zum erwachsenen Fisch aus, welcher nach Ablaichen stirbt.

Das Ei ist kugelig von Form und hat einen Durchmesser von etwa 1,0mm. Es hat eine Eimembran, deren animale Halbkugel mit einer dickeren sog. Anklebemenbran überdeckt ist; aber die letztere verbindet sich am mikropylaren Teil mit der ersteren (Textabb. 1 u. Tafel I 2). In der Anklebemembran, deren äussere Oberfläche klebrig und deren Rand, wie Abb. 4 (Tafel I) zeigt, mannigfach verkrümmt ist, lassen sich viele verschiedenartige kleine Poren erkennen (Tafel I 4 u. Tafel II 5 .

Erst wenn das Ei der Bewegung des Wassers ausgesetzt wird, löst die Anklebemembran sich teilweise vom Eikörper, umschlingt einen Fremdkörper, an dem sie kleben bleibt, oder sie wird erst nach dem Ankleben an einem Fremdkörper durch die Wasserströmung teilweise vom Ei abgestreift. (Textabb. 2) Folglich geschieht der Anklebeprozess des Eies unabhängig von der Befruchtung oder Ei-Aktivierung.

Noch eingehenderer Beobachtung nach, ist Folgendes klar geworden.

Mit Befruchtung zerfallen die Kortikalalveoli, dann tritt ein Perivitellinraum auf, und danach beginnt allmählich die erhabene Keimscheibe sich zu bilden. Da diese Veränderung auch nur beim Eintauchen in Wasser und in Salzlösung geschieht, ist es denkbar, dass die Ei-Aktivierung dabei parthenogenetisch geschieht.

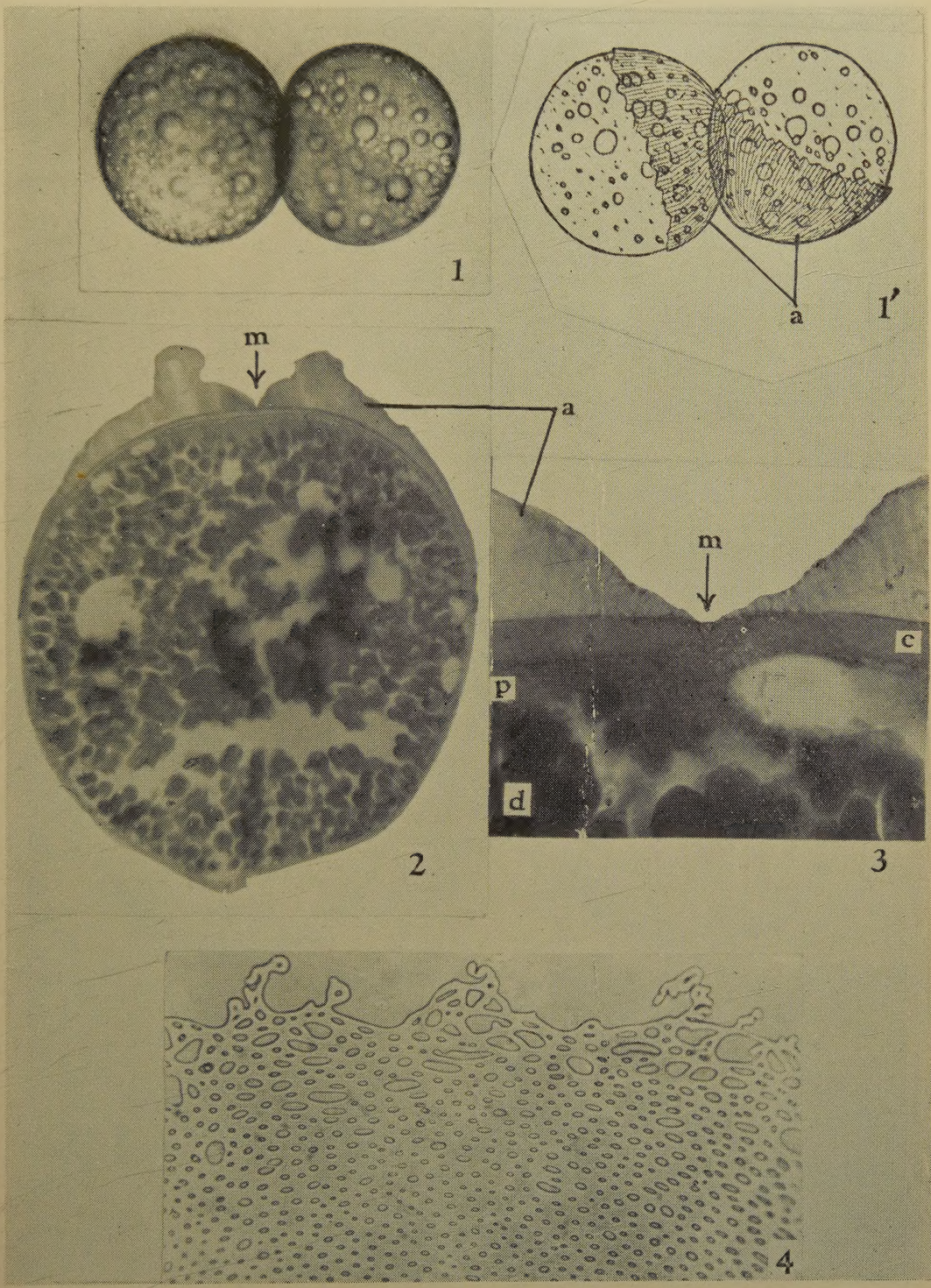
Einige Experimente, dieses Problem betreffend, sind ausgeführt und diskutiert worden.

Erkläruug der Abbildungen auf Tafeln

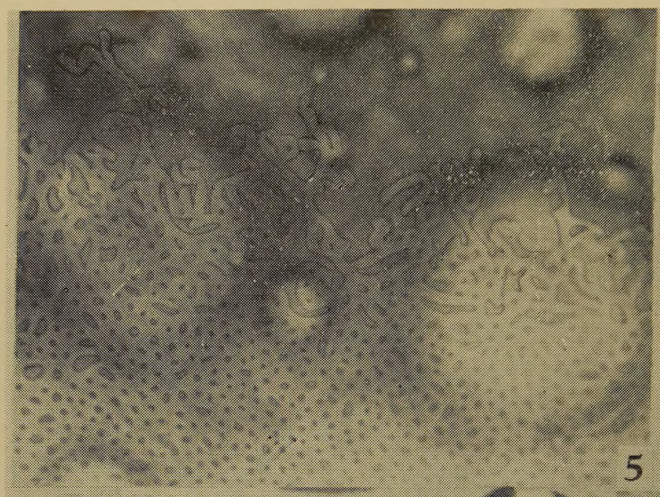
Verzeichnis der Abkürzungen

a Anklebemembran

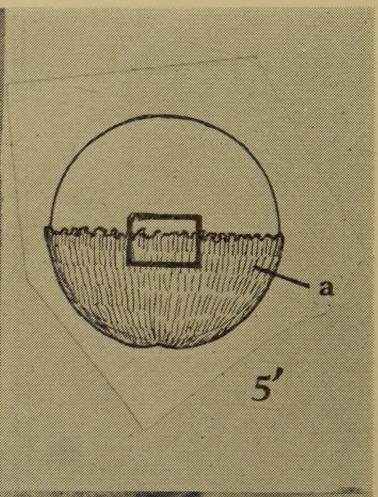
Tafel. I



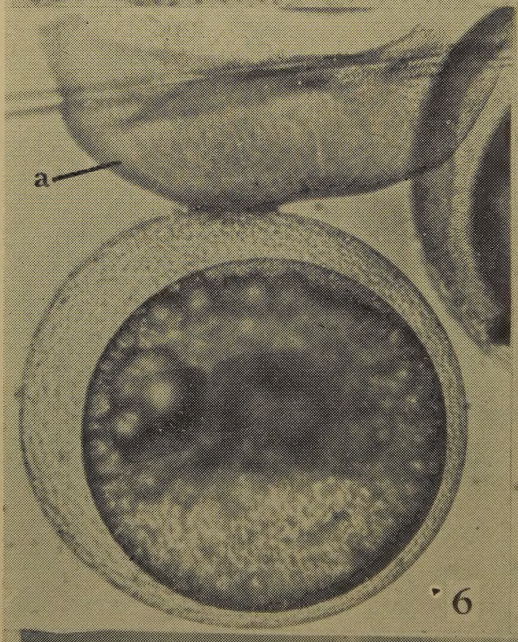
Tafel. II



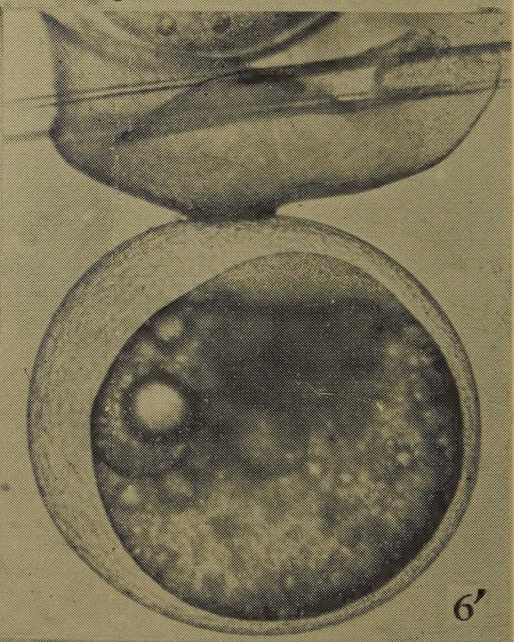
5



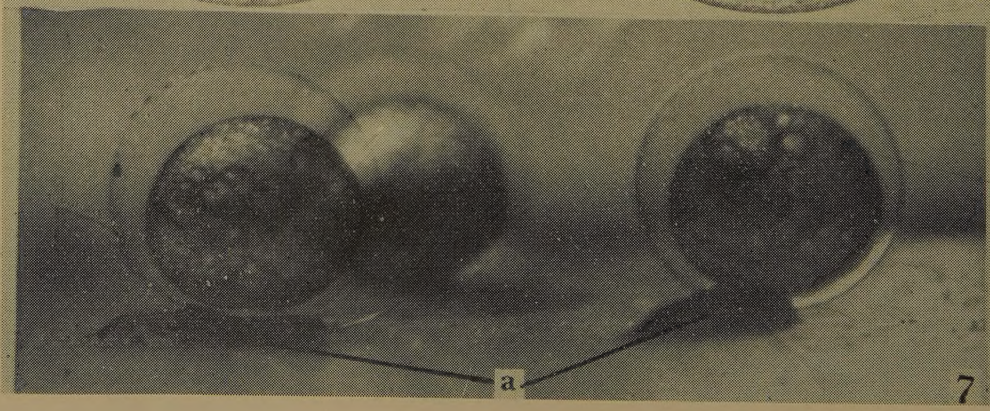
5′



6



6′



7

c Eimembran
d Dotterkörnchen
m Mikropyle
p Ooplasma

1 Intakte Reifeier. Mit Anklebemembran gedeckte Hälften sind etwas dunkel, wie aus 1′ hervorgeht. 35x

1′ Schematische Darstellung der Eier in 1.

2 Querschnitt durch den Pol der Mikropyle nach Fixierung, gefärbt mit Haematoxylin und Eosin. 100x Wegen der Fixierung ist die Anklebemembran ziemlich verquollen. Siehe Textabb. 1.

3 Bereich der Mikropyle (Querschnitt). 700x

4 Ein Teil der von der Eimembran abgeschälten Anklebemembran. Siehe Poren und mannigfach verkrümmten Rand derselben. 300x

5 Ein Teil der Oberfläche des intakten Reifeies, Vergrösserung des in 5′ durch das Rechteck begrenzten Teiles. 300x

6 u. 6′ Im Wasser hängende Eier. 65x Seitliche Aufnahme

6 Nach 30 Minuten im Wasser

6′ Nach 2 Stunden dasselbe Ei. (Temp. 21° C)

7 Dem Grund des Wasser anklebende Eier. 40x Seitliche Aufnahme

A Method to Mark the Time in the Scale and other Hard Tissues of Fishes to see their Growth*

Yoshio HIYAMA and Ryushi ICHIKAWA
(Fisheries Institute, Faculty of Agriculture, Tokyo University)

Introduction

Observing scale and other hard tissues under microscope for age determination of fishes, it so frequently happens that the one would be embarrassed to find out the right year mark from the similar ring or discontinuity, so in some times the problem is brought into argument.

In that case, the method to find out the right year mark or the spawning mark we have now is that either to get the fact on seasonal change of the feature of scale or to get the detail frequency curve of body size by measuring a huge number of specimens enough to find out the peaks for corresponding ages.

The authors have been trying to find out the way to mark the time in living tissues of scale and others usually used for age determination so as to desolve this problem since long time. Meanwhile, Drs. OKADA and MIMURA, Profs. of Tokyo Medico-dental College, succeeded to make a dark lead mark in teeth of Rhodenta by injecting dilute lead-acetate solution into vein.

The authors getting their idea and the technical advice, made a serries of similar sort of experiments to apply it to hard tissues of fishes. At the first step, we studies the adquet method for fish by using the fish reared in the laboratory tank. And at the second step, applied the established method in chance of tagging experiment to see the natural growth until the fish recaptured. The results we obtained are quite satisfactory, so the authors intend to introduce the method, which may available for any sort of fish the growth of these tissues are still under argument, and also would describe the feature of growth of these tissues observed by our experiment.

From our experience of several years, the authors want to recommend the application of this method to tagging experiment, if anybody wants to know about the natural growth of these hard tissues. And, we believe there may be more way of application of this method in fisheries biology.

Method to Mark Lead-line

As OKADA and MIMURA's method is for teeth of Rhodenta, we should reexamine and improve it to be appliable to the hard tissues of fishes. Prior to the mass experiment, the following experiments were done to find out the best method, using gold fish about 5 to 20 grams weight in aquarium inside of the laboratory.

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* 本研究は文部省科學研究費によるものである。

1) The Method of Injection

a) As Okada & Mimura did, we tried to inject the solution to the artery or vein. However, as the blood vessels of the tiny fish of this size is so fine in the part near to the body surface, that we shoud give up to do it after so many fruitless trials. Moreover, by the injection to the thicker vessels near the heart, we sacrificed many fishes in every trial with the fruitless effort, as it is hard to find out the right location from outside of the body wall.

b) Then we turned to do it by abdominal injection. In so many cases of our trial, we injured the viscera and it sometimes brought the fish to die.

c) The next trial is to keep the fish alive in the tank where dilute solution of Pb-acetate is kept during certain duration of time, so as to the fish may absorb it through gill membrane or other external part of body directly contacting with the water.

0.001% solution (10 mg per litre, of Pb-acetate is prepared in the glass tank (140 mgr per litre is lethal concentration), where gold fish of about 10 grams weight were kept about one hour long.

But the result of examination of scale shows no clear lead mark is deposited in any part. We did not continue the same sort of experiment in more concentrated solution, as the following method, carried on simultaneously proved to be better and easier.

d) Finally, we found that the method to inject the solution to body muscle is the one most satisfactory from the stand point of effect of deposition and easiness of handling. The most adequet part of body muscle to inject is the middle part of dorsal side, where the muscle is most thick in many kind of fish.

And the injection should be done pricking the scaled skin with the injection needle obliquely from back to foward. The needle we used in most of our experiments has its diameter $\frac{1}{4}$ mm, as we found the finer the needle the result are more satisfactory, and its point should be sharpened by grinding it so frequently.

The injection should be done as slowly as possible so as to avoid the solution might leak out from the body. There was no particular technical need to have fish to be narcotised prior to the injection about the fish kinds as far as we tried.

2) The Proper Amount of Pb-acetate For Fish

To decide the amount and the concentration of the solution, we had to do some experiment, as the amount decided by Okada & Mimura for Rhodenta for vein injection might be different from that for our purpose. The material used for these series of experiments is a number of fish having body weights from 5 to 7 grams, and the results obtained are as follows.

To obtain the precise deposition of lead in scale, the more the amount of Pb-acetate is injected the mark is the more clear. However, to reduce the effect to the health of fish especially to apply it for tagging experiment, the amount of Pb-acetate should be limited in certain amount.

As obviously shown in Table 1, the proper amount enough to present the lead mark and less effect for fish health is about 0.1 to 0.5 mgr of Pb-acetate weight in the solution

Table 1.

	Concentration of Pb-acetate	Volume of solution per 10 grm of fish weight	Weight of Pb-acetate in it	Pb-mark in scale	Influence to fish health
1	1 %	0.1 c.c.	1 mgr	Clear	Decomposition of muscle in the part injected.
2	1 %	0.05 c.c.	0.5mgr	Clear	Healthy
3	0.5 %	0.1 c.c.	0.5mgr	Clear	Healthy
4	0.1 %	0.1 c.c.	0.1mgr	Clear	Healthy
5	0.04 %	0.05 c.c.	0.02mgr	Invisible	Healthy

for every 10 gr of body weight of fish. This amount of Pb-acetate for fish is about 10 to 25 times of that amount found adequet for Rhodenta by Okada & Mimura.

This discrepancy would be caused by the difference of the injection method, the nature of animal and that of tissue. The authors in the application of this method for all sorts of fish kind, as far as the authors tried, injected 0.1 c.c. of 0.1 to 0.5% solution of it for every 10 gr of fish body weight. And this standard amount is also effective to present lead mark in other calcified tissue. though In the case of observation of bones, 0.1 c.c. of 0.1% is enough to present a lead mark if it is examined as a cross section, but in the case of observing it from the surface, it is necessary to inject 0.1 c.c. of 0.5 % solution, unless the mark is too faint to see. Fin rays were always observed in cross section by microscope, so 0.1 c.c. of 0.1% solution is enough to produce lead mark.

3) How To Examine Lead Mark

After the injection of Pb-acetate, the scale and other calcified tissues taken off from the fish killed shows no remarkable signiture of deposition of lead under microscope without having the following treatment.

Scale

The scale taken off from the fish is kept in the small glass bottle, containing the water to which the scale is immerged. And the H_2S gas are lead into the bottom of the bottle by glass tube, being supplied by Kipp's gas generater (FeS+HCl), passing through the washing bottle having water in it. By this apparatus, the water in which the scale is, could be saturated by H_2S continuously. In this condition, the scale of usual size should be kept during about one hour, and then Pb deposited in the tissue would turn into PbS, which appear as dark line under optical observation. To make the line more clear and more stable, it is better to gild the lead granules by gold. So, after washing the scale treated by H_2S by water, it is immerged into 0.1 % solution of $AuCl_3$ during 10 to 20 minutes. And after then, put it into 5 % solution of Sodium thiosulphate, so as to remove

the excess of gold adhered to the surface of the scale out. Then the dark lead line would turn to blue under optical observation by transmitted light.

Fin-rays, Centrums of Vertebrae and Opercle

For these tissues, H_2S gas should be lead into acid (1 % solution of HCl or 1.8 % HNO_3) where the tissue is immerged, during about 24 hours. And after washing it by water, the tissue are treated by $AuCl_3$ during a half hour, as mentioned in foregoing chapter. To use the acid for these tissues is a sort of decalcification, which is done simultaneously during sulphuration. It is necessary for the thick tissue like the centrum of vertebrae to do this during long time, while for the thinner tissue like the scale, the weak acid like H_2S itself is enough for the purpose.

How Soon Lead is Deposited

How soon after Pb-acetate solution was injected to the muscle the lead would deposited in these tissues is the problem to be cleared, so as to know the exact growth of tissue by this method So, the two experiments were undertaken.

1). A gold fish (about 4 gram weight) was injected by 0.04 c.c. of 0.1 % Pb-acetate solution to muscle, and have kept in tank where the water temp. 10° C, and scales are taken off one by one after certain period, and examined. The results are as follows,

Table 2.

Time passed after injection	10 min.	30 〃	1 hr.	2 〃	3 〃	5 〃	2 days	3 〃	4 〃	5 〃	6 〃	7 〃	8 〃	9 〃	10 〃	11 〃	12 〃
Presence (P) or Absence (A) of lead mark in scale	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	P

As shown in Table 2, it needs 12 days since injection to get obvious lead deposition in scale by this experiment.

The result we obtained is quite different from the fact that Okada & Mimura (1934) described, *i. e.* 2 hours are enough to have lead mark in teeth of Rhodenta after the injection to vein.

This considerable discrepancy might be caused by the differences of tissue, animal and the method of injection.

However, in later experience the common gobby (*Acanthogobius flavimanus*) being injected in occaision of tagging liberation and examined one hour after it, had clear lead mark in scale. So, the authors have to think that the speed of secretion of lead on scale layer would be various according to the species of animal used.

2). About twenty individuals of gold fish, from 3 to 7 gr in weight, are injected by 0.1 mgr of Pb-acetate per 10 gr of fish body weight at May 27th 1952, and reared in tank where the water temperature is about 20° C being fed by usual food (powdered silk worm cocoon). And, after various duration of time, an individual is killed to find out the

lead deposition in each case. The duration of time since injection is as follows,

2 hours, 5 hours, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days, 8 days, 9 days, 10 days, 11 days, 12 days.

The result of examination is that no trace of deposition was seen on the scale from the one up to the 9 days'. The scale from fish killed after 10 days shows slight mark, which is somewhat clearer in that of 11 days, and more clearly appeared in that of 12 days. Also operculum and fin rays are taken from this series of specimens for the examination. However, even though comparing the one taken from the 11 days' and 12 days' specimen with that of not injected, no remarkable difference was recognised between them. One of the reason of it might be the amount of medicine would not be enough to make lead mark clear in these tissue. About our numerous specimens experimented, the shortest case in which lead deposition taken place successfully in fin rays and bones is about one month after the injection about gold fish.

The Microscopic Feature of Growth of Calcified Tissue

As lead deposition is supposed to happen followed by calcium deposition in these tissues the more active the calcium secretion the more obvious and dark the lead mark in these tissues. And the dark line clearly shows the time when it is deposited. So, the feature of growth can be cleared experimentally as follows.

1) Cycloid Scale

The following was affirmed by scales of gold fish and carp. If the scale treated by this method is observed from the surface, it shows the cloud like spread dark area at the central part of it as usual. (Fig. 1) It is darker in its central part and thinner in its periferal part. And always there is a considerable broad marginal area being transparent as deposition of lead is slight.

And it is remarkable that the parts where radius runs are transparent also. These features can be considered, as Neave (1940 already mentioned that the scale is formed by secretion of collagenous substance at first stage, and then after certain duration of time calcium is added to it. So the lead deposition occured only in the part where calcium secretion have taken place, and the marginal area newly made is left to be transparent.

And also the part where radius runs would have no calcium secretion, as already Tayler (1914) stated. It might be considered that the border line of central dark area is the line where calcium was depositing with Pb after certain duration of time since Pb-acetate is injected. So if the marginal line where calcium is deposited at the time when fish was killed is found, by the method such as haematoxylin or $AgNo_3$ staining, the grown part with calcium deposition since Pb had deposited can be measured from the surface of the scale. However, the border of the both lead area and calcium is not so clear by surface observation to measure it accurately, and the cross section of scale made by paraffine-section method shows something more exact feature. Fig 3 and Photo I & II shows a cross section of scale cut in the direction along the body axis of fish, which was taken

from the fish killed after the injection. As it is clearly shown by the figure, the lead lies in the layer upper from the extreme bottom of scale. The line lies much deeper in exposed part of scale (right side in Fig. 3) than the part covered by neighboring scale (left side in Fig. 3). And, at the part crossing the radius, the lead line comes up near to the surface, having its peak not stained as shown in Figs. 3, 4, 5 & 6 and Photo II as point R.

These features are quite coincident with that can be supposed from the surface view. However, it is not recognized by the surface observation that in cross section even though the lead deposition is more faint than in the central area, the lead line extends to the peripheral part of the scale up to the extreme termination of both anterior (left in figure) and posterior (right in figure) of scale. The feature of front termination is enlarged in Photo. I, and that of the part near radius is also enlarged in Photo. II.

The authors have to consider by these fact that the new layer of scale is formed by the secretion of substance from the epithelium of scale sac, which is especially active at the part lining the scale bottom, not as the form of calcium compounds but as the matter without calcium compound, as Neave (1940) thought it is a sort of collagenous substance.

To make this sure, the calcium staining by $AgNO_3$ was tried to the same section of scale. And as it is shown in Fig. 4 and Photo. III, the dark staining by Ag, which proves the presense of calcium compounds, is found merely at the part of section upper from the lead line.

And at the exposed part right side in Fig. 4) the calcification takes place more sooner after the scale layer is formed than the covered part (left side in Fig. 4), as it can be seen from the section that more thicker bony portion (calcified layer) and more thinner fibrillary portion (non-calcified collagenous layer) in the exposed part than in the covered part.

So as to get the calcium compounds deposited on the layer lies in the middle of the scale layer, the calcium compound, which is usually thought to be secreted from the epithelium of scale sac, should have come from either external covering epithelium or the internal lining epithelium surrounding the scale.

This origin of calcium secretion was cleared by the experiment to do the second injection succeedingly after certain period of time since the first injection, using different amount of Pb-acetate for same weight of fish body.

The first time, 1/50 mgr of Pb-acetate for 10 gram weight of gold fish was injected. And after four months since then 1/2 mgr of Pb acetate (25 times of the first injection) was injected to the same fish. This coupled injection makes the clear double line in the cross section of scale, as shown in Fig. 6, having the thicker lead line at deeper layer than that of the first one. This tells that the calcium secretion from the scale sac would be made by the epithelium lining the bottom of scale, depositing to inner layer, penetrating through the collageneous part. As this experiment was done using the gold fish reared in the narrow tank, no remarkadle growth of both scale and body was shown. However, the authers want to suggest the application of this coupled injection, so as to

see the exact growth, to any sort of aquatic living which might have convenient chance to do such as recapture of tagged fish or the fish easily reared in natural condition.

Moreover, there is another method to see the natural growth of scale by single injection at chance of tagging liberation. That is, as Fig. 3 shows the lead line extends to the both termination, the covered and the exposed part of scale, and there very thin collagenous layer exists. So if the scale grown since the time of injection at tagging liberation, the new layer would be formed beneath the lead mark extending to the border of scale. Therefore, if the part outer than the lead mark (arrow marked part in Fig. 7) is measured that is it which grown while the fish had been in nature since the time when tagged, injected, and liberated. (The dotted line in Fig. 7 is the line supposed to be the margin of scale when injected) This is a way to know about the amount and feature of growth of scale. However, the method requires the scale examination by cross section of it.

2) Ctenoid Scale

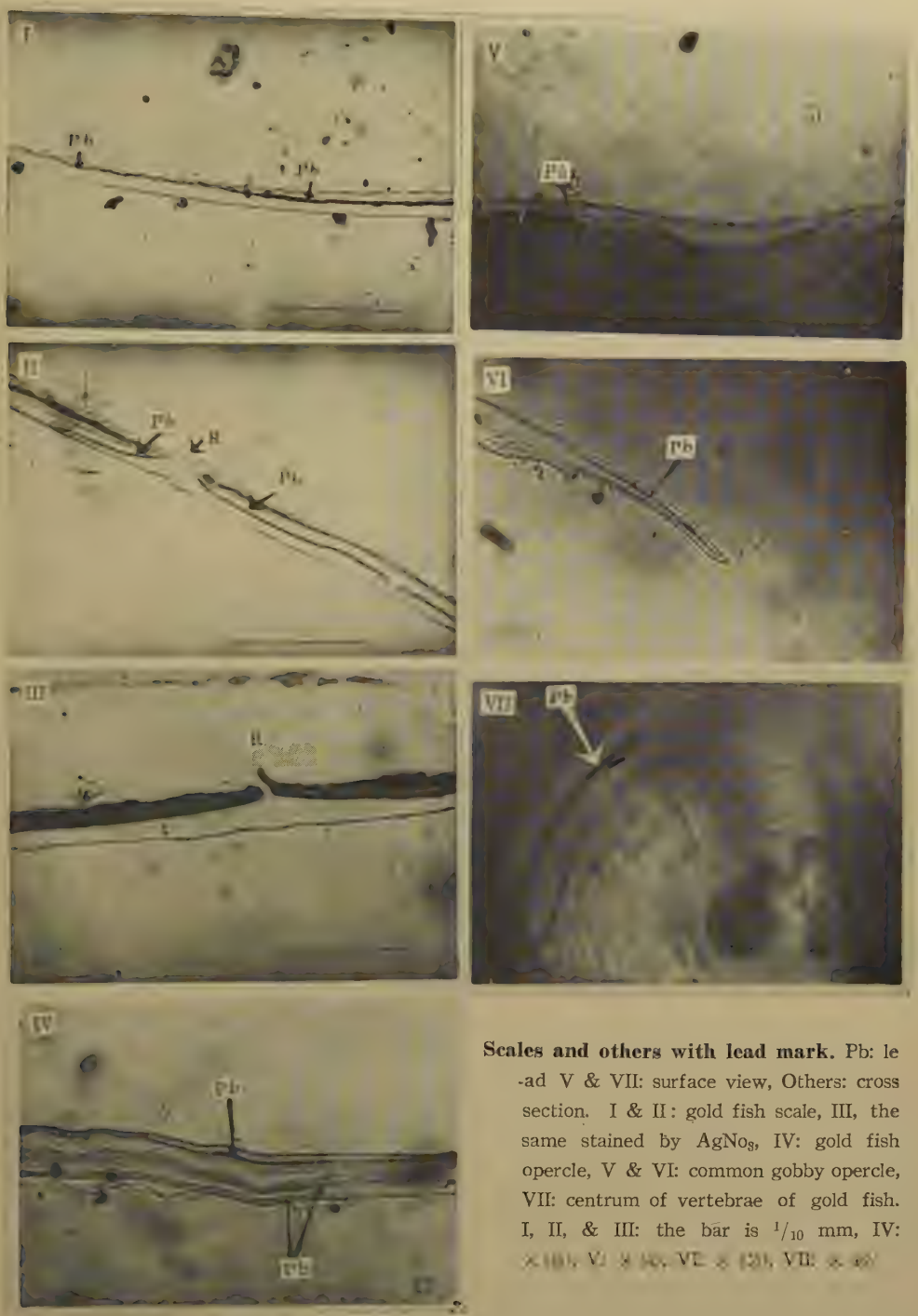
As the fish having ctenoid type of scale the Common gobby, *Acanthogobius flavimanus* was selected, as we had chance to do the tagging experiment by this. As most of features of lead mark of this caused by injection of Pb-actate are similar to those of cycloid scale already mentioned in foregoing chapter, such as the depth of lead line in cross section, and the feature around radii, so a few should be described here (Fig. 2) However, one peculiar feature was noticed by surface view of ctenoid scale which was not shown in cycloid scale.

That is a dark narrow lead line running along the margin of scale where fringed by the serration. (Pb in Fig. 2) The cross section of the scale (Fig. 5) tells the nature of this lead line clearly, *i. e.* it is caused by the vertical arrangement of the lead line at that point, while in most of other parts it runs horizontally in cross section. This vertical part is formed as the result of thick calcification at the part of serration (T in Fig. 5), which may add the strength to the construction of the serration. This peculiarity of ctenoid scales enables to know about the growth of scale by surface view. That is, if the newly grown part of scale is formed since the injection it should be added at the outer or marginal part from this lead line. Therefore, if the peripheral terminal of the lead line running along the serrated margin is distinct, the part outer from it should be considered as the newly made layer. So, the amount and the feature of growth since the fish was tagged, injected and liberated can be observed and measured by surface observation of scale.

3) Fin-rays

Though it is well supposed that the bony spines of fins should have the same lead mark if Pb-acetate is injected, but the soft rays is merely observed as it is more easy to make paraffine section for the examination. For this purpose, a gold fish of 3 gram weight is treated as follows.

The second soft ray of left pectoral fin was examined by section. (Fig. 9) The asymmetry shown in figure of coupled branch of a fin ray is caused by its nature, as



Scales and others with lead mark. Pb: le -ad V & VII: surface view, Others: cross section. I & II: gold fish scale, III, the same stained by $AgNo_3$, IV: gold fish opercle, V & VI: common gobby opercle, VII: centrum of vertebrae of gold fish. I, II, & III: the bar is $^1/_{10}$ mm, IV: ×10, V: × 30, VI: × 20, VII: × 40

Fig. 1

Fig. 2

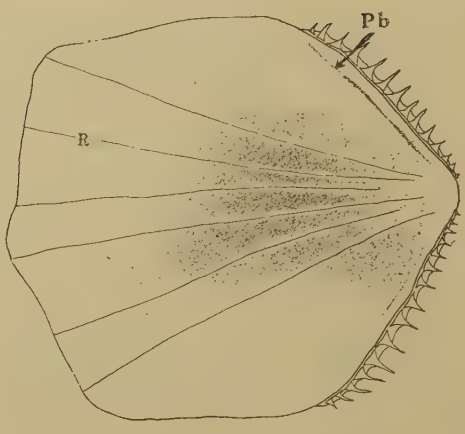


Fig. 3

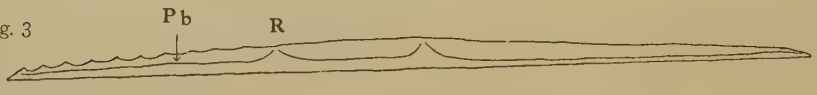


Fig. 4

Fig. 5

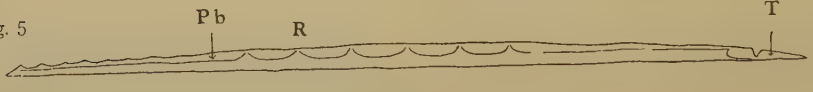


Fig 6

Fig. 7

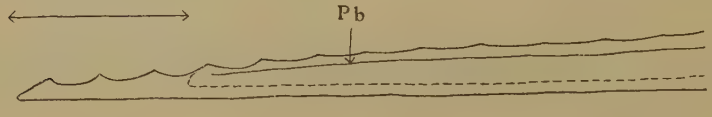


Fig. 8

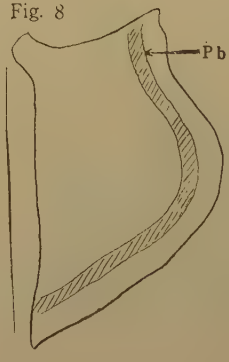
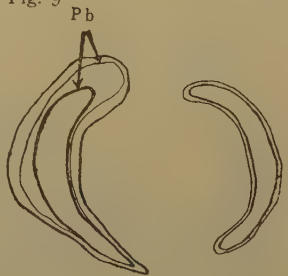


Fig. 9



Scales and others with lead mark. Pb: lead mark, R: radius, T: serration. Materials: Figs. 1, 3, 4, 6, 7, 8, 9, Gold fish, Figs 2 & 5 Commom goby. Figs. 1 & 2: surface view, ×25. Figs 3–7: cross section, Figs. 3, 4, 5, × 50: Figs 6 & 7, ×170. Right is exposed part in all figs. Fig. 1 shows dark central area. Fig 2 shows dark line beside it. Fig. 3 cycloid scale. Fig. 4. Calcium was stained by $AgNO_3$. Fig. 5. Ctenoid scale. Fig. 6. part of radius by coupled injection. Fig. 7. Newly grown part (arrow mark). Fig. 8. Surface view of opercle, Fig. 9. Fin ray by coupled injection.

Table. 3

Date	Pb-acetate		Amount of Pb-acetate per 10 gram of body weight
	Concentration	Amount of Solution	
Aug. 14. 1951	0.5 %	0.03 c.c.	0.5 mgr
Sept. 19, 1951	0.1 %	0.03 c.c.	0.1 mgr
Nov. 7, 1951	Killed and examined		

the outer branch is usually bigger than the inner branch in pectoral fin rays. (the body located right side of Fig. 9) The feature of growth is shown in cross section by coupled injection, having the second mark thinner than the first one. That tells the secretion of calcium is made by the epithelium covering the ray, adding the new layer to the outer margine. And the activity of secretion is not homogeneous as the two lead line is not running equally parallel. It is more rapid and active by the outer branch, than the inner one, and more at external and upper part of the outer branch, as this degree of activity of secretion can be measured by the distance of two lead lines.

The bony spine is more common to be used as age determination than soft ray. The authors are quite certain the same would be observed in bony spine as well as soft ray.

4) Centrum of vertebrae

The centrum of vertebrae taken out from the same fish as used for the examination of fin rays described in foregoing chapter shows also the deposition of lead observing from the surface. (Photo. Ⅶ) Though we made the couple of injection, the lead line appeared was a single. Probably, the amount of Pb-acetate injected in the second time was too few to see it without getting the cross section of it. The grinding or paraffine section of this part is technically difficult, as its section should be cut by a surface near to cone. The feature of lead mark observed from surface is something near to the ring usually thought to be year-ring by majorities of fisheries biologist.

Though nothing new is added by us to the knowledge of growth of centrum, but this method tells the possibility to measure the grown part, which is the part from lead ring to the border, since Pb-acetate is injected.

5) Operculum

From the same fish as mentioned in the chapter of fin rays, the membrane bone of operculum was taken off and examined.

By the macroscopic surface view, a dark Pb-line came out along the posterior margin of opercle, nearly parallel to its marginal line. (Fig. 8) As the line is single, though the coupled injection was made, so the cross section was made to see it in detail. (Photo. Ⅳ)

As shown in photo. VI, the outer fainter lead line is found in the section, supposed to be the one made by the second injection. So, the one observed from the surface should be the one made by the first injection which is much thicker enough to be observed from the surface. The trace of both lead lines running parallel to its free margine tells the way of growth of this sort of membrane bone, which is not so far from the idea already thought by many biologists.

The operculum from the Common gobby recaptured after tagging with Pb-acetate injection is also examined (Photo. V & VI).

Although the specimen shown in Photo. V and VI was recaptured after twenty four days since tagging and injection, even if about the one examined immediately after injection, always the lead line apart from its free is posterior margine. This tells that, in this kind of fish, at the peripheral part of operculum the calcified layer is more thinner than gold fish described previosly, seeing it from the lead line in cross section (Photo. VI), and this one had few growth in twenty four days. So the dark broad area (Photo. V) observed from the surface is the part at where the two lines, outer and inner, are more thicker than other part. The part outer from the part surrounded by the two lead lines is not calcified being collagenous still.

This point should be considered to measure the grown part of opercle since injection in some sort of fish like this Common gobby. This is the difference between this species and the gold fish in which uncalcified part is very thin and negligible to measure the growth.

As the operculum is a part of body available to age determination, so to see the natural growth of it, our method is available. And if the amount of Pb-acetate is enough there is no neccessity to make cross section.

6) Otolith

As the otolith of fish is generally used for the age determination, so we had to work out the same method about this hard tissue. However, so many specimen we treated by various amount of solution have the otolith without any trace of lead deposition. This exception would be understood that calcium in the otolith is a form of calcium carbonate, which usually hard to deposit lead in secretion.

About tissues previously mentioned and got fine lead mark, calcium is supposed to be in the state of phosphate.

However, this is merely a supposition. So, about the reason and the method to make the time impression in this tissue would be studied further.

Effect of Injection to Survival Rate

Gold fish and carp injected by medicine and reared in the laboratory shows no significant physiological influence seeing from their behavior, and if the amount is adequet as mentioned in previous chapter no bad effect is found for their survival.

However, in the case injected when it is tagged, having the tag as a physiological burdon, some effect to the physiological condition of the fish could be considered.

So the differerence of survival rate between non-injected tagged fish and injected tagged fish are examined by the result of tagging experiment of the Common gobby.

977 individuals of the Common Gobby were tagged by silver band and celluloid disc at Tokyo Bay, in them 362 individuals were injected by lead-acetate and 615 were not injected. The number of fish recaptured and reported was 58 individuals in total, where 18 were injected and 40 were not, The rate of recovery is 4.9 % for injected fish and 6.5 % for non-injected fish.

As the difference between the figures of the rate of recapture is very small, so if we can keep the figure within this extent by other fish kinds, the application of this method would have so many hopes in future.

Conclusion

Here the authors introduced the method to make the time mark in hard tissues of fishes by lead-acetate injection to see the growth of these tissues, which is devised from Okada & Mimura's method. The method is combined with the tagging experiment to see the natural growth. The recapture of the tagged fish was too early to show the exact growth of tissues in this experiment, however, seeing the feature of growth of these tissues we could find out many points to be available to know the growth of these tissues beside the coupled injection method which is usually available for the fish in cultivation. We believe more other application of this method for fisheries biology would be found in future.

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Study of the Japanese Sardine, *Sardinia melanosticta* (Temminck et Schlegel). III.

On Scale - 2

Osamu Tamura
(Faculty of Fisheries, Nagasaki University, Sasebo)

Introduction

I reported in the preceding paper, "On Scale-1", the outcome of the study of the Japanese sardine, with special reference to "Lea's phenomenon". In this treatise the time of formation of the periodic scale-rings is the subject. I express my gratitude for the instructive advice by Prof. Ikusaku Amemiya and for the assistance of Mr. Motokichi Morishima and the late Mr. Kanji Tsutsumi.

A. Determination of the periodic scale-rings

1. Nature of the scale and periodic scale-rings

Generally speaking, external shapes of scales of many kind of fish vary extremely by the body-parts, and the variability of the periodic rings are also remarkable. For the determination of the periodic rings I compared the variability in respect to each body-part and the reliability of ring-readings in the raw material of the sardine of two rings caught at Mito (Sizuoka Prefecture), 1938, mean body-length 174 mm. Refering to fig 1, I examined nearly the whole scales of each region of 15 body-parts; each number shows alternate scale from anterior to posterior. Refer to plate I, table 1 in regard to the positions of rings.

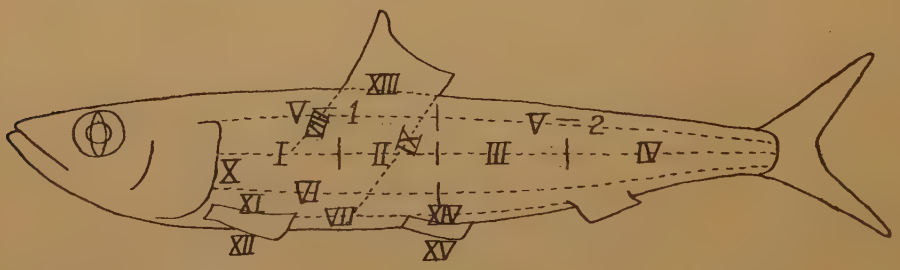

Fig. 1. The position of each body-part compared.

2. Periodic rings for age-determination

Concerning the natures of Periodic rings for the age-determination I described in the previous report of ring-composition, several points must be added as follows:

(1) The ring appearing on side is irregularly discontinuous in many cases at the region passing from side to apex, the ring is clear at apex, appears always at side on the extension. Then, it can be considered as a real ring when there is a ring at apex and side even unclear, but it can not be taken for a real ring when there is a ring only at side even clear.

(2) The reason for considering as "normal position" of rings in the previous treatise

Table 1. Characters of scales of each body-part.

part	largeness of covered portion	shape	ring	$R-r_2'/r_2$	remarks
I	19% > IV	near typical form	can be detected with difficulty	2.1%	uncovered portion large, considerably hard to fall off
II	20% > IV	most typical	clear	2.3%	very easy to fall off
III	16% > IV	typical	most clear	1.9%	more easy to fall than II
IV no.1~4	—	typical	indistinct	2.8%	most deciduous
IV no.5~8	—	irregular	indistinct		
V no. 1	≒ IV	near typical	—	4.1%	deciduous
V no. 2	7% < I		hard to recognize	3.1%	
VI no. 1	25% > IV	upper margin project, projection decrease gradually	—	3.9%	comparatively hard to fall off
VI no. 2	16% > IV		hard to recognize		
VII	12% > I	symmetric laterally, upper margin project	—	6.1%	same
VIII	—	circuli very irregular	—	2.7%	deciduous
IX	10% > IV	upper margin project in dorsal & ventral scale, in median symmetric	comparatively clear, apical portion hard to see	4.7%	deciduous
X no.1~3	—	very irregular	—	—	very hard to fall off
X no.4~6	—	—	considerably clear	—	
XI	anterior part very small, posterior larger gradually	transformed greatly, no. 10 normal	no. 5~ considerably clear	5.3%	most hard to fall off
XII	anterior small, posterior larger	irregular	most indistinct	5.7%	same
XIII	—	elongated, distribution of radii special	many indistinct	—	comparatively hard to fall off
XIV	—	near XI	some clear	—	same
XV	—	irregular	indistinct	—	hard to fall off
XVI	—	tip of uncovered portion project sharply	clear	—	easy to fall off
				mean 2.2% s. e. 0.174	

of ring-composition is that each ring is distant from each other in ratio nearly of 20: 12: 7: 5: 3. (refer to my treatise, Scale 1.: A 2, Real length).

(3) In the scale possessing typical form and a clear ring, the ring can be identified distinctly even thin or narrow, consequently I am apt to decide it as a real ring, contrary to this, in the scale lacking typical form and having many pseudo-rings or injured scales they have unclear rings in many cases and the rings can not be observed distinctly even if they are thick or broad. Therefore it must be judged as a real ring only when it is thicker than a certain thickness, however it is hard to decide practically.

B. Time of formation of periodic rings

1. The ratio of appearance of rings by continuous sampling of o-year fishes

I examined the samples for ten months from May, 1939 to February, 1940 (failed in September and November). Scales of 5 or more were taken in each individual from lateral axis under dorsal fin. I designated 5/5 the case which all scales had equal rings on same positions, 3/5 the case which only 3 in 5 scales had equal rings on same position, etc. as reliability. Further I expressed the case as 1/5 which only one scale had several rings (chiefly one, rarely two or three rings).

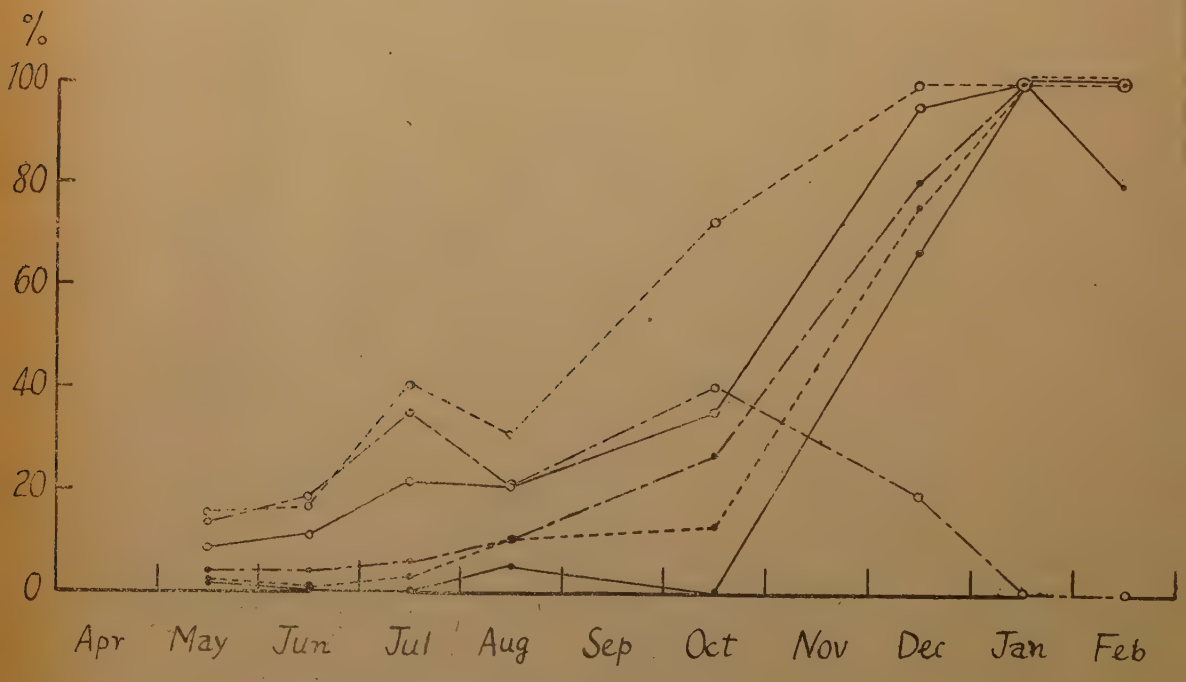

Fig. 2. Ratio of the appearance of the first ring in 0-year fishes (sampled at Misaki)
Note: •——• 5/5, •·····• 4/5 + 5/5, •——- -——• 3/5 + 4/5 + 5/5,
o——o 2/5 + ··· + 5/5, o·····o 1/5 +···+ 5/5, o-------o 1/5 + 2/5

These are indicated in Fig. 2. The graphs of 5/5 and 5/5+4/5 ascend steeply to higher 70% from very lower 13% between October and Decmber. Many scales sampled at second and third decades of December possessed ring at margin. The ring appeared in samples caught in Jauary or February is observed often on inner side from margin, even though there is a few situating at margin. The graphs of 5/5 + 4/5……+1/5 and 5/5+4/5……+2/5 increase slowly with progress of months, in July especially higher, both becomes 100% in January.

From the above-mentioned I can deduce that the so called summer ring may be formed to a certain extent in July or August but the real ring which almost all fishes possess must be formed in July or February, as far as shoals about Miaski (Pacific) are concerned.

2. Distance from last ring to margin

As already Mr. YASUDA (1940) dealt with, the ratio of the distance from last ring to margin for the length of covered portion, namely $R-r_2'/r_2'$ must show minimum value at te time of ring-formation. He denied the advocation of Prof Aikawa (1940) by indicating figure of plotting values in every month, his conclusion that the time of minimum value may be once a year is not apparent by his figure. Further, since this value is very different by age, I used as many as reliable samples having clear rings in each group of each number of rings and compared with each other the average value in every month.

This is indicated in Fig. 3~6, provided that the higher values than $r_{n+1}-r_n/r_{n+1}$ by the reports (Aikawa 1940, Amemiya and Tamura 1949, Yasuda 1950, and Satō 1950) must be these of abnormal growth or exceptional formation. If these values are contained in the distribution, these make indistinct the loop of frequeucy curve by influencing upon the distribution, accordingly these are omitted. As the results of summing up the values of Aikawa, Amemiya and Tamura, and Satō, the following have theapproximate value of $r_{n+1}-r_n/r_{n+1}$ of maximum in the previous month (or in the next previous month) and indicate the minimum (loop) such as:

r_1…14→5% summer; 17→7% winter, r_2…9→6% summer; 10→4% winter,
r_3…8→2% winter, r_4…6→2% summer; 5→1% winter.

In the values of r_2-r_1/r_2 each mode (by Aikawa, Amemiya & Thmura, Sato) in August separates extremely, but this case seems rather natural, because there can be many chances which the scales of fish are able to be catched immediately before or after the forming of the first ring, if the true ring is formed about August. Further, as the values of r_3-r_2/r_3, r_4-r_3/r_4, and r_5-r_4/r_5 decrease and the positions of minimum values become obscure, these are indicated as the average in each month calculated to adapt to the values of r_2-r_1/r_2 by the Table 2.

From the above-mentioned the following canbe deduced.

(1) There are minimum in summer and winter in the value $R-lr/R$ of r_1, r_2, and r_4. It appears from the Fig. 4~6 that ring will be formed twice a year, but it can not be deduced that the double formation will be effected normally, because, even if two rings can be formed on scales of every individual fish in general,

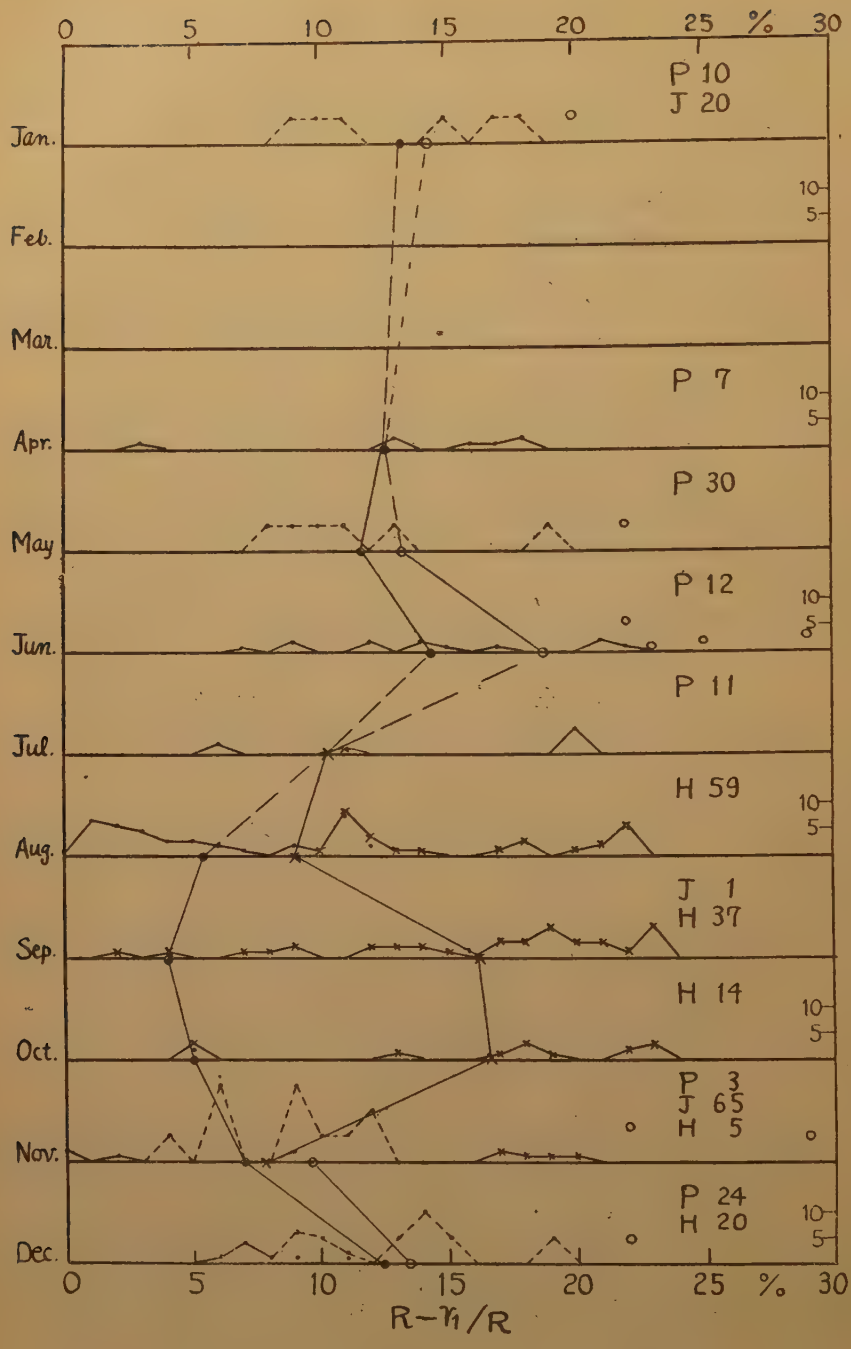

Fig. 3 Note: P……Pacific, J……Japan Sea, H……Hokkaid, K……Kiushu.
•……• …Aikawa, ● …average from (Aikawa+Tamura)
•——• …Tamura, ○ …average from {Aikawa+Tamura+(R-r_1/R>r_2-r_1/r_2)}
×——× …Satō, × …average from (Aikawa+Tamura+Satō)

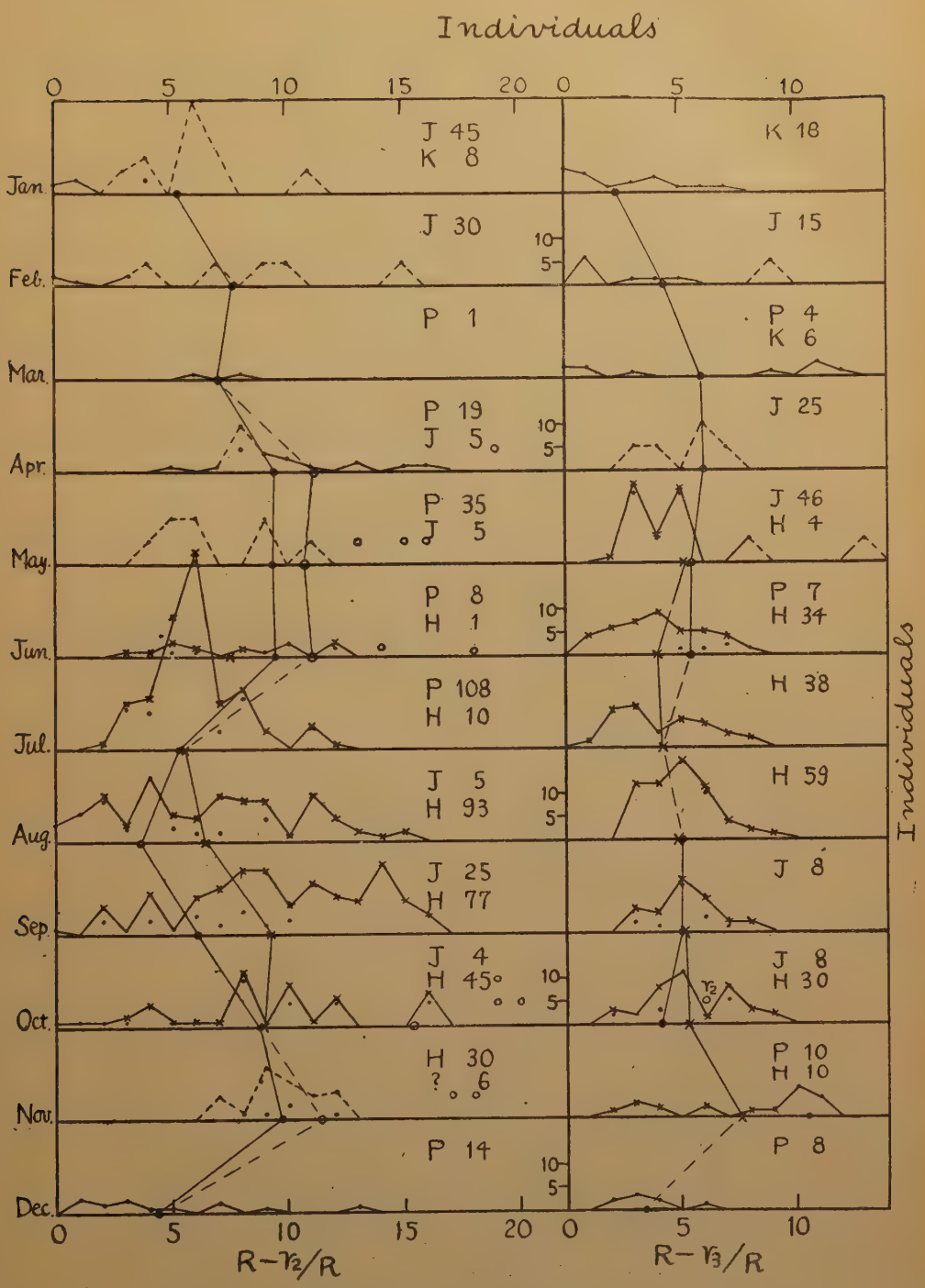

Fig. 4. $R-r_2$, r_3/R in each month.

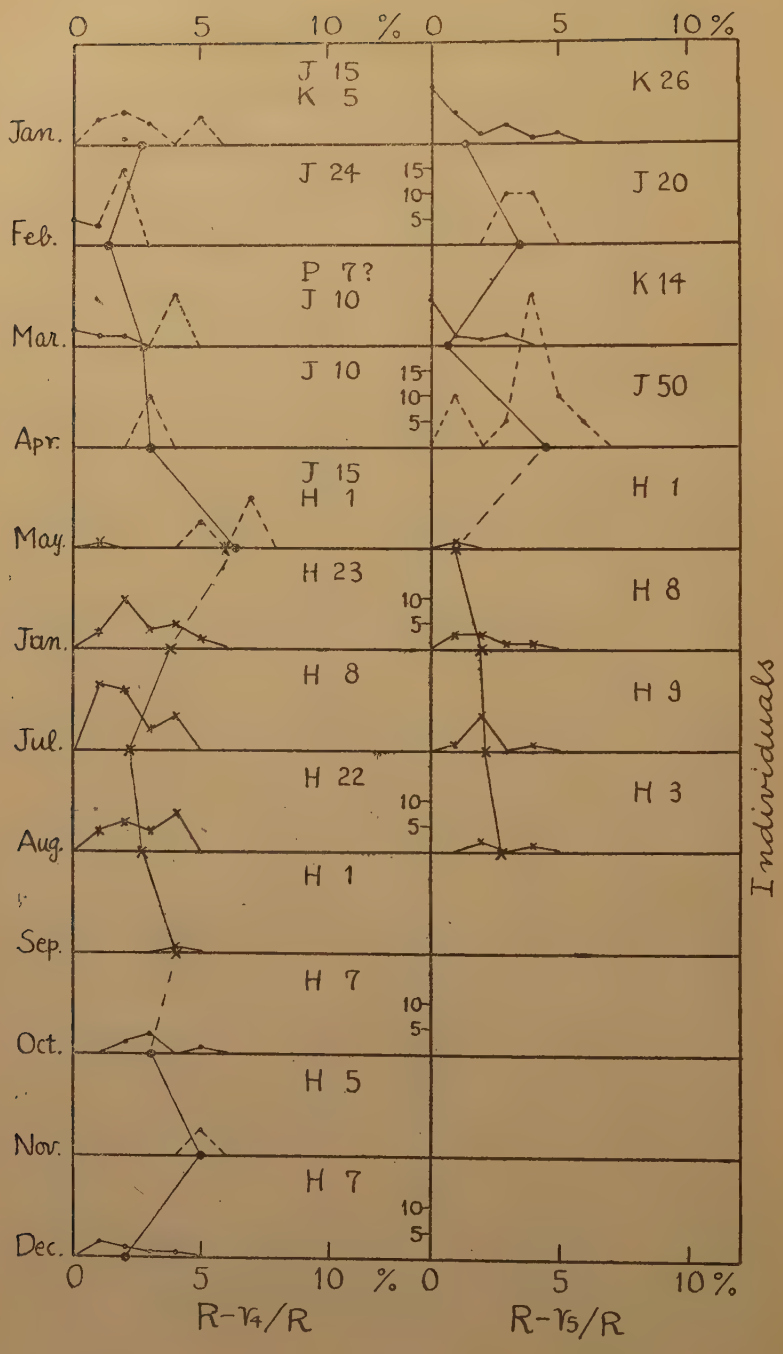

Fig. 5. R-$r_{4,5}$/R in each month.

Table 2. The ratios of $R-r^n/R$ in each ring-class

ring-class	Aikawa	Sato	Amemiya & Tamura	average	$r_{n+1}-r_n/r_{n+1}$	$r_{n+1}-r_n/r_{n+1}$: r_1-r_0/r_1
	mm	mm	mm	mm	%	
r_1	3.18	3.02	3.49	3.20	20.6	1.00
r_2	3.81	3.94	4.33	4.03	13.5	1.53
r_3	4.47	4.69	4.83	4.66	8.3	2.49
r_4	4.93	5.13	5.17	5.08	5.4	3.82
r_5	5.36	5.39	5.36	5.33	—	—

accordingly the following can exist, namely r_1 as winter ring, r_2 as summer, r_3 as winter and r_4 as summer ring, but not these of r_1 as summer, r_2 as winter, r_3 as summer and r_4 as winter ring for instance. There are also no ring-compositions of catch such as composed from the classes of only odd or even number of rings, accordingly the double ring must not be formed.

(2) Then, r_1, r_2 and r_4 may be winter or summer ring respectively, and some fishes may have the winter ring only, other fishes may have the summer ring only.

(3) There are differences of results by investigators in the length of the distance from focus to the last ring and also in $R-1r/R$ of r_1 and r_2 after the summer in the figure (Fig. 3. 4. . The reason of these differences seems to depend on the locality, on the individual variety and also on the disagreement of the standard judgement by the investigators.

(4) Considering however that I have selected only clear ones of small percentage in observed number of scales and moreover the time of the formation must be deduced to be summer and winter, this result may be presumed as follows:
This may arise from containing many scales such as having summer ring accidently which appear at low percentage as indicated in Figure 2, or. the summer ring may come out usually, but some fishes having summer rings may have no winter rings and other fishes having winter rings may have no summer rings.

Therefore, the next hypothesis can be assumed.

a. If the summer and winter ring are both true ring,
   i. the fishes having summer ring may form no winter ring, accordingly r_1, r_2, r_3 and r_4 may be all summer ring;
   ii. the fishes having winter ring may form no summer ring, accordingly r_1, r_2, r_3, and r_4 may be all winter ring;
   iii. the period of ring-formation may be different according to localities;
   iv. there may be difference of period to form ring by year classes, for example, Mr. Yasuda (1950) reported that the sample from Tokyo Bay in autumn, 1942 hat r_1 but that from the same in winter, 1948 had no ring.

b. If the summer ring is pseudo-ring and the winter ring is true ring,

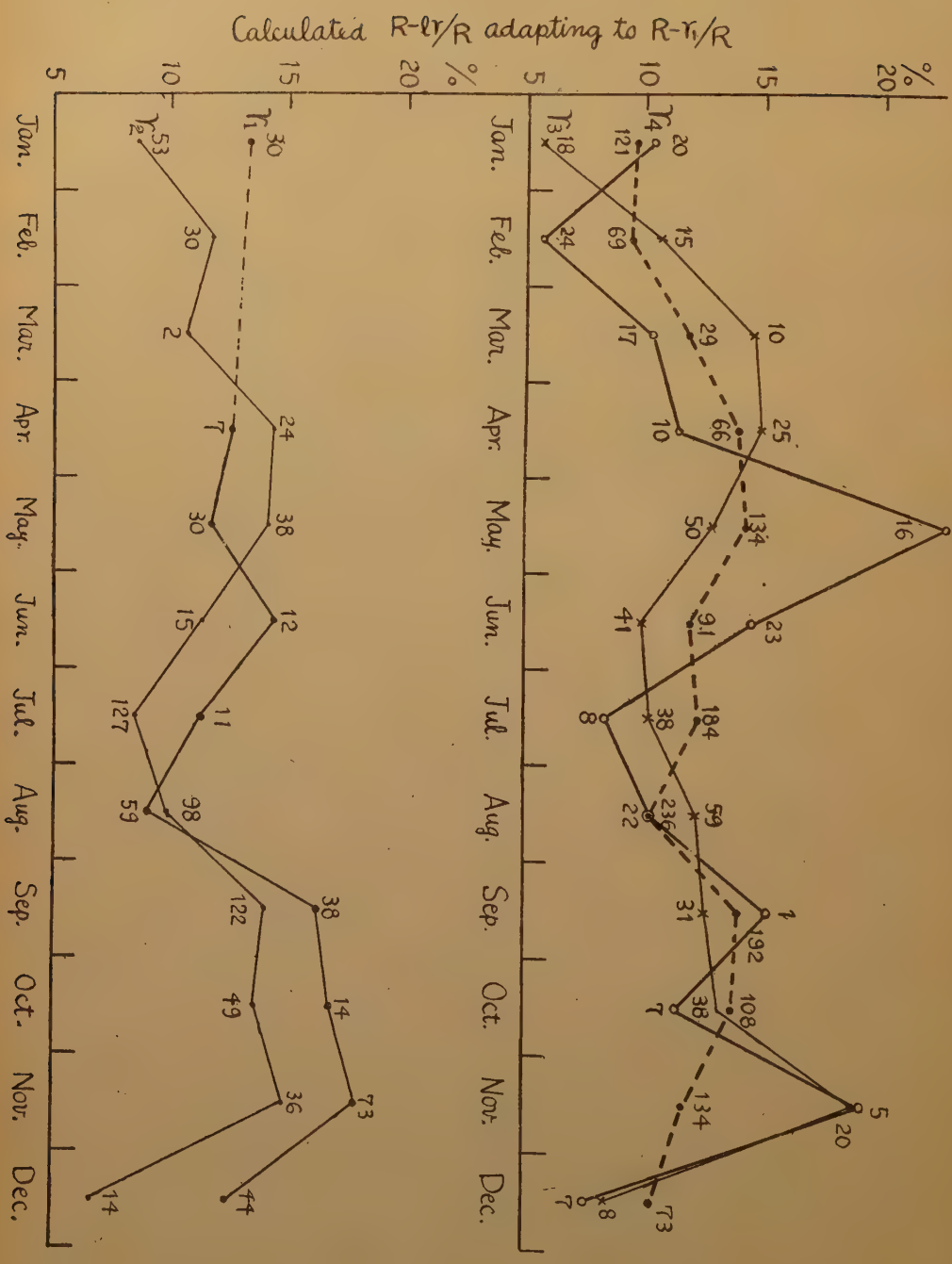

Fig. 6. Calculated R-lr/R adapting to R-r_1/R in each month.

i. the summer ring may be formed from the resembled cause to spawning ring, appearing only in the damaged fishes, in this case accordingly the values of R-1r/R may be high in summer and the minimum may be indistinct when a large number of scales were observed.

ii. I might have confused the summer ring with the winter ring. In the case of a. i or ii, since the scale forming the summer ring must be in winter and the scale forming the winter ring must be in summer in good condition physiologically, both scale must belong to groups in greatly different conditions. Consequently, in the group having same body-length at same locality, the value of R-1r/R must show only minimum once a year. As the samples of the author include fishes from various localities, the future observation must be carried on the sample having same body-length of same locality, and also the samples having different body-length of different localities must be compared.

Since the instability of the standard reading of scale ring increase the difficulty to solve the problem, the contradiction of the reports by many investigators will not easy to solve without making a clear distinction between true and false ring at least, according to the agreed standard judgement, by means of the adequate discussion in all cases by photograph or others.

3. Relation between the growth of body-length and the calculated body-length at the formation of each ring

According to the real length of the distance from focus to ring, the calculated body-length at the moment of ring-forming disagree remarkably among the data of many reports.

While the actual growth-rate of body-length disagree among the data by several investigators considerably, it is not able to presume the time of the ringformation of r_n by the method of the calculated l_n depending on the growth-rate of body-lenght.

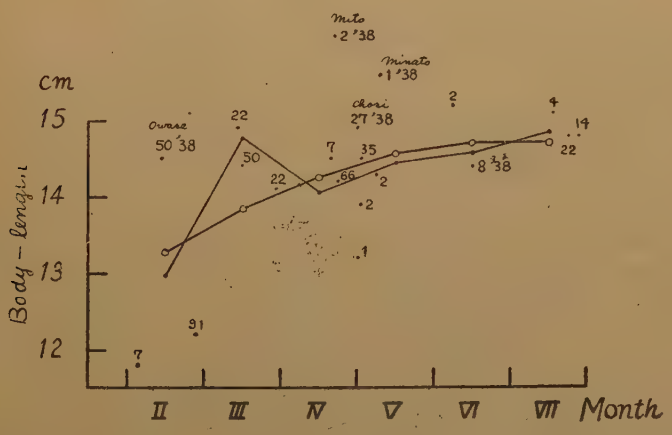

Fig. 7. The growth of 1-ring fishes sampled in the Pacific (1937, Misaki)
Note: •——• experimental value, o——o theoretical value

4. Time of formation of last ring

The calculation of the time of last ring from the relation between the scale-length (R) and last ring is in danger of considerable inaccuracy caused by the large variability of scale, but it seems easy to perceive the general estimate about the time, when a large number of samples are used as data. I tried to calculate it from the reliable data (by which 1_n found) of our samples which were not so sufficient. In the latter formula r_n/r'_n is the correcting factor of the large differences of the growth by individuals or scales.

$$X' = (t_{n+1} - t_n) \cdot r_n/r_n' \cdot (R - r_n')/(r_{n+1} - r_n)$$

(r_n'……distance trom focus to last ring: R……scale-length at the time of sampling: r_n……average distance from focus to n'th-ring of all Japan corrected for the phenomenon of decreasing scale-length, X'……interval between the time of formation of last ring and that of samling, t_n……time of forming r_n).

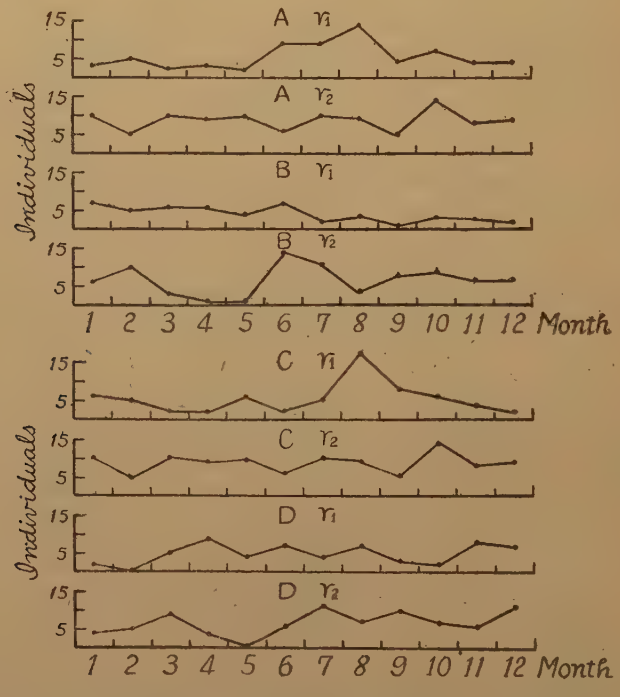

Fig. 8. Presumption of the time of the last ring-formation

When Aikawa's growth-rate is adopted in $t_{n+1}-t_n$, the value of t_2-t_1, t_3-t_2, and so on become 8, 5, 8, 7 months respectively. (Fig. 8. A . In Fig. 8. B, t_n shows that from Yasuda's growth-rate. The figure 8. C and D are the results from assuming the $t_{n+1}-t_n$ as 6 and 12 months respectively. But this inclination is not certain, since there are no agreement of the ring-length and of the standard judgement of scale-reading.

Judging from the former results collectively, it can not be concluded that the rings are formed twice a year, it is presumed rather that there exist the sardines forming the summer ring and too the other sardines forming the winter ring.

There is no knowing what the first ring is to be formed during summer or winter. It may be perhaps partly derived from the differences by locality, considering that the samples of the Pacific are presumed to form first ring during winter, in view of the former b i. Since the cause of this result may deduced to that the summer rings of the samples from Japan Sea may give a strong effect on the distribution of R-1r/R in each month, these tendency may indicate the loop of summer as seen in the Figure 3~6.

C. The cause of the formation of periodic rings

There are several factors considered as the causes of the formation of periodic rings of sardine like other kinds of fishes, water-temperature, food and spawning, etc. Taking into consideration of that the spawning seems to have little effect on the summer or winter ring of O-year fish and there exist accessory rings regarded as the spawning ring, this may be probably adequate to infer as on cause of the periodic rings comming into question.

By the report of Plankton Review (1940) the total amount of plankton and that of diatom of every month (Fig. 9) show both the minimum in December or January or February and in July or August. These agree in several points with the former results, and the water-temperature are also about minimum or maximum in these months, accordingly the ring-formation may be resulted from these factors.

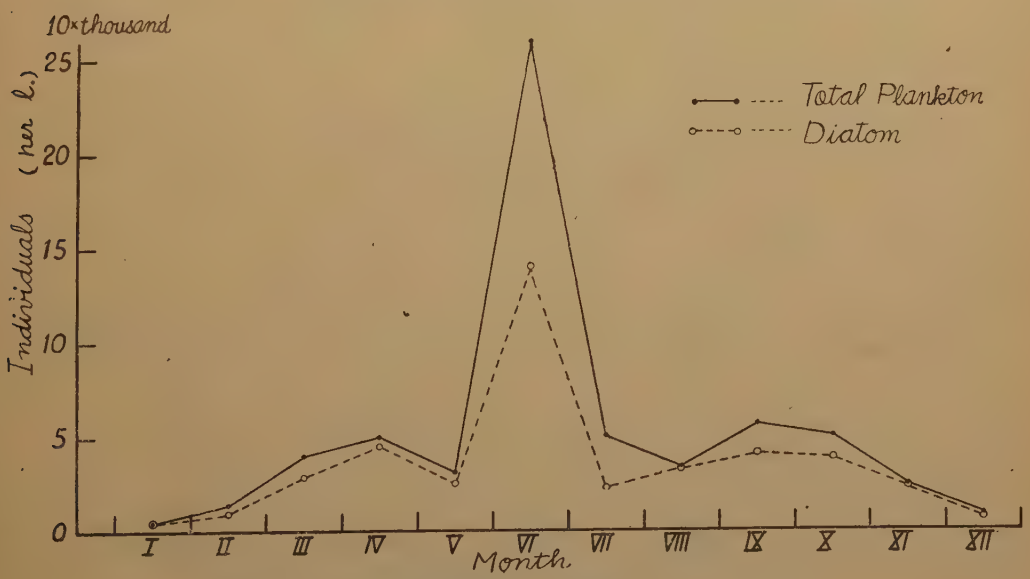

Fig. 9. Monthly fluctuation of plankton
(samples of 12~15 positions, mean of 3 years)

D. Discussion

Mr. Yasuda (1950) compared the distributions of the frequency of ring-length and body-length, and concluded that the r_1', r_2' must be false ring, because the frequency of appearance of r_1', r_2' is few but that of r_3' is many. The value of the r_3'-length

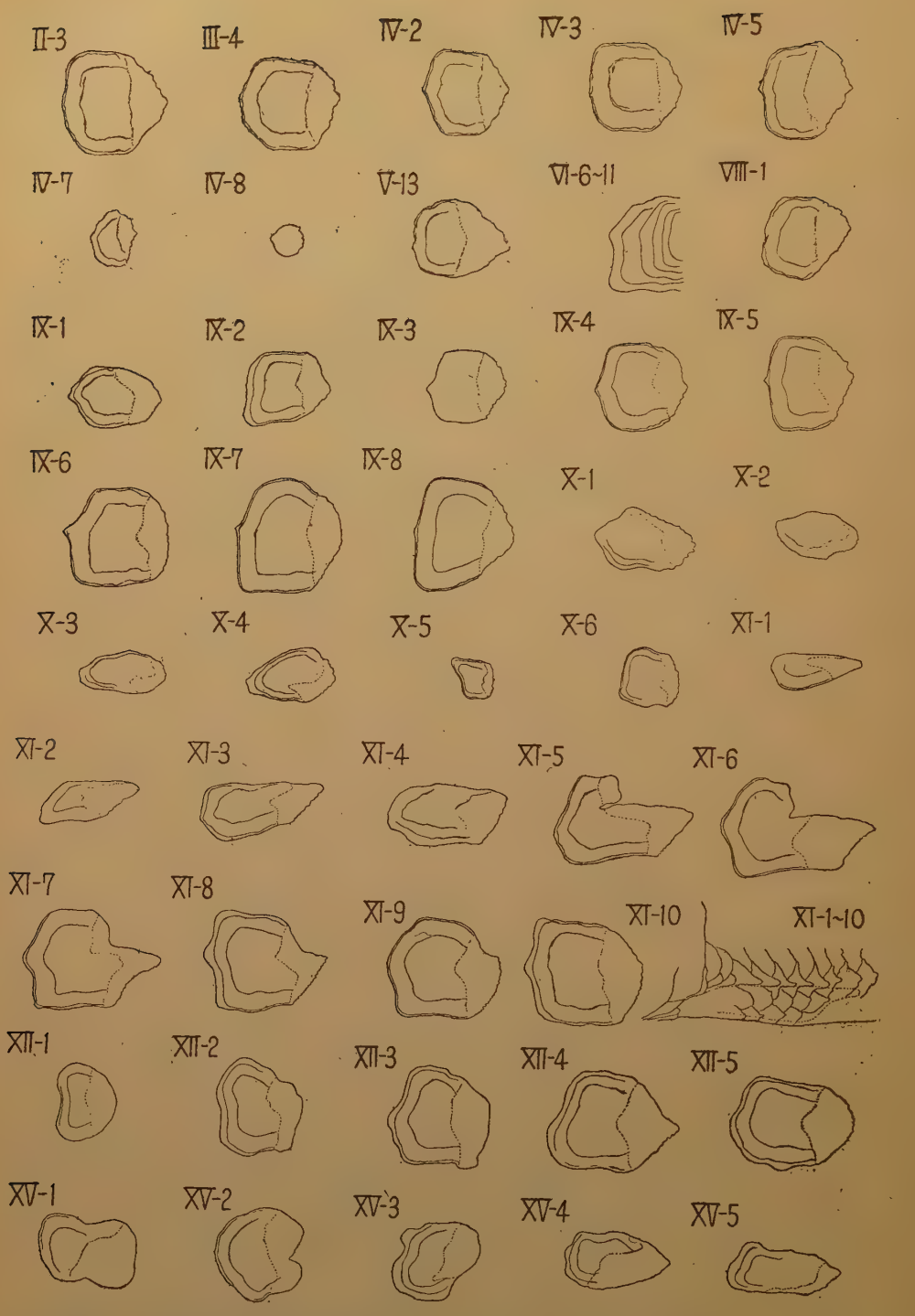

Plate 1. The variation in the shapes or the rings of scales according to body-parts (ca×3/2)

by Mr. Yasuda approaches that of r_2-length by Prof. Aikawa (1940) and the r_1-length by Amemiya and Tamura (1949), but different from the r_1-, r_2-length by Satō & others (1950). Then, the r_1 by Aikawa (1940) is regarded as the pseudo-ring certainly, but the other disagreement may depend upon the difference of the standard to determine rings.

On R-1r/R, the value from the first ring ($r_1=r_3'$) shows minimum in summer (June, July), that from the second ring indicate minimum in spring and summer (April, July) in the samples taken from off Jōban (1942-1943) by Mr. Yasuda (1950), but minimum of the value from r_1 can not be observed in his figure. Having no sample in winter or summer in the report by Satō (1950), the minimum of R-1r/R is unknown.

By M. blackburn (1949) the Australian sardine (*S. neopilchardus*) is presumed to form r_1 in October~December, as well as r_2, r_3, and r_4 mainly in July~August according to the number of scales having the value of $1-1_n$ (body-length——calculated body-length) less than 10mm in each month. His method may be not so different from that of the R-1r/R, as the growth of the fish having $1-1_n$ of less than 10mm is slow in these months relying on the Petersen method.

Putting together the above-mentioned, the possibility of the formation of summer ring may be large, however on the time of formation of each ring, it is necessary to ascertain the month of minimum of R-1r/R, by means of adding more abundant samples from many localities and of many year-classes. In addition, the decision of the time of ring-formation or the certain age-determination will be acomplished, by making agree the standard of scale-reading among investigators in order to coincide with each ring-length, also by making clear the difference of growth between localities or year-classes.

Résumé

1. The form of scale at each body-part, the scale-length and the positions of rings were compared with each other.
2. There were several additiond features of the periodic rings to the former report, "Scale-1".
3. Concerning the time of the formation of the periodic ring, the percentage of O-year fishes possessing the rings on scales, the distance between the last ring and the margin of scales, the method calculating the time of the formation of the last ring were discussed.
4. The time of the formation of the first true ring is winter (about January or February) in samples from the Pacific (Misaki 1934).
5. The ring-formation may be found in both summer and winter, but nobody can confirm the rings to be true or otherwise.
6. The first winter ring will be perhaps the true ring, but in some fishes rings are formed in the summer after the second year too.
7. The cause of the formation of the periodlic rings is presumed to be the effects

of food and water-temperature on scale in the worst conditions at the same time.

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Comparative Studies of the Scales in Japanese Freshwater Fishes, with Special Reference to Phylogeny and Evolution

Hisao KOBAYASI
(Department of Biology, Aiti Gakugei University)

I. Introduction

It has been recognized for a long time that scales are of great significance in fish classification, but it is quite strange that fish systematists should have hitherto attached too mach importance to scale number or size and neglected scale form and structure. Those who have ever engaged in this line of study might have realized what a convenient material scale character is to consider the affinity between fishes. We may, therefore, by studying the difference in scale character, correct the errors which some systematists committed in their classification of fishes, and by further consideration, may even imagine the affinity between fishes, and accordingly the relation of phylogeny or evolution, too. Needless to say, however, it is dangerous to discuss phylogeny by a single morphological character, while it is rather impossible, though easy to speak, to consider phylogeny after studying all characters, especially in smaller groups of animals, apart from larger groups of them (such as phyla and calsses). Knowing these circumstances well, the auther has studied in this paper the phylogeny of freshwater fishes, and that considerably in detail —— in some cases the phylogenetic relation between species, subspecies or varieties, too —— making scale character his keynote and taking into consideration as many other morphological characters as possible. He believes that scale character is the best material for studying the affinity between fishes, and that no other strcture shows the phylogeny of fishes better than that, which the author emphasized in the Japanese Journal of Ichthyology (1951) and the Zoological Magzine (1951).

As a matter of fact, phylogenetic studies are so full of adventures that some scholars (*e. g.*, N. YATSU, in his Classification Table of Animals, 1938) regard the group Chaetognatha as a phylum which ranks at the lowest part of the Enterocoel stem, while others (*e. g.* T. KOMAI, in his Classification Table for the Course in Systematic Zoology, 1949), as a class in phylum Annelida belonging to the Teloblast stem, which is quite another stem. And then the animal group Endoprocta is regarded by some scholars (*e. g.*, N. YATSU) as an independent phylum, while by others (*e. g.*, T. KOMAI), as a class in Molluscoidea. Phylogeny is so difficult a problem to solve.

This study of the author's is limited within Order Teleostei in Subclass Teleostomi under Class Pisces in Vertebrata, and the relation between families, their origins, and the phylogentic relation between subfamilies, and furthermore, the relation of affinity between genera, species, sometimes subspecies, or varieties being considered here, it may not be so serious a mattar even if the study is not successful, and it may be considered of great value if successful. And the author believes that in this paper he could judge those relations quite calmly, with scale character as the ground and center of the judgment.

There are actually a great number of variations in scale character. Even in the same individual, scales are very different in form and structure, according to the portion of the body which they are attached to. In some extreme cases, it is not seldom that we find ctenoid scales in the center of the body side (c. b. s.), but cycloid scales on the breast and belly. Moreover, scales have their own characteristics respectively like plant-leaves, and no two identical ones can be found even in the same portion

of the body of the same individual; they are just like finger or sole pattern of man. But in spite of such variations in form and structure, when they are minutely observed, they are by no means mere disorder, but have the characteristcs of the genus, species, or the race in the species, which the fish belongs to.

To avoid complexity, however, in the comparative study between fishes, scales in c. b. s. and on the side of caudal peduncle (s. c. p.) are used. According to the group of fishes, scales in c. b. s. are more suitable as in Salmonidae and Gobiidae, and scales on s. c. p., as in Cyprinidae. When the specimen of a fish is at hand, the author examined and compared the scales, taking them from as many portions as possible, and using as many of them as possible.

The greater part of the Japanese freshwater fishes are included in this study, as you will be seen in the following table (scaleless Petromyzontidae, Salangidae, Siluridae, Bagridae, Flutidae, Pleuronectidae, Cottidae, and *Leucopsarion petersi* in Gobiidae being excepted; Acipenseridae with ganoid scales, and Gasterosteidae with scutes studied by K., IKEDA, in 1933, being also excepted), and in addition to them, those closely related to them and found in the neighbouring islands of Japan, i. e., Formosa, Sakhalin, Kuriles, and in the neighbouring Continent, i. e. Corea, Manchuria and China, or further away in Central Asia, Europe and Hawaii, are also used, amounting to 23 families, 85 genera, or 161 species (or subspecies) of fishes.

To denote the two stuctures, which are the most important elements in scale sculpture, the technical terms Grooves (Radii), and Ridges (Circuli) are used, in accordance with the author's point of view in 1951 (Jap. Jour. Ichthyol., Vol. 1, No. 3).

As to the systematical studies covering the whole fish lepidology, there is an old one by T. D. A. COCKERELL, and a new excellent one on Cyprinidae by Y. T. CHU, while on Japanese Cyprinidae, Cobitidae, Plecoglossidae, etc., there is the author's and on Salmonidae, OHNO & ANDO's and M. OSHIMA's. The author referred not only to these papers, but also to as many papers as he could which have anything to do with scales, reinspecting the figures and photos shown in them and comparing them with those of his own collection, and borrowed from these papers only those impossible for him to collect, after carefully examining them.

The general system of classification of Pisces is chiefly based upon OKADA & MATSUBARA's "Key to the Fishes and Fish-like Animals in Japan", and as to the fishes of the Continent, MORI's Illustrated Encyclopedia of the Fauna of Japan, and MIYADI's Freshwater Fishes in Manchuria, were always referred to, the specimens of the group identified by its specialist being used, and when classifying them himself, the original papers of classification were referred to as much as possible, and above all, the books mentioned below were always kept at his elbow.

KOBAYASI, H. 1935: The Japanese Freshwater Fishes, and their Parasites (in Japanese). Yôkendô, Tokyo.

OKADA, Y. & NAKAMURA, M. 1948: The Japanese Freshwater Fishes (in Japanese). Nihon-shuppansha, Osaka.

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II. Table of fishes used in this study

(( ) Japanese species
  [ ] Exotic species)

Class PISCES
Subclass TELEOSTOMI
Order TELEOSTEI

I Suborder ISOSPONDYLI

[1] Family Engrauridae
Genus *Coilia*
(1) *Coilia mystus* (Linnaeus)
(2) *Coilia ectenes* Jordan et Seale

[2] Family Dorosomatidae
Genus *Clupanodon*
(3) *Clupanodon punctatus* (Temminck et Schlegel)

[3] Family Coregonidae
1) Genus *Coregonus*
[4] *Coregonus ussuriensis* Berg
[5] *Coregonus alvula* Linnaeus
2) Genus *Brachymystax*
[6] *Brachymystax lenok* (Pallas)

[4] Family Salmonidae
1) Genus *Oncorhynchus*
(7) *Oncorhynchus nerka* (Walbaum)
(8) *Oncorhynchus nerka adonis* (Jordan et McGregor)
(9) *Oncorhynchus kawamurae* Jordan et McGregor
(10) *Oncorhynchus gorbuscha* (Walbaum)
(11) *Oncorhynchus keta* (Walbaum)
(12) *Oncorhynchus kisutsch* (Walbaum)
(13) *Oncorhynchus tschawytcha* (Walbaum)
(14) *Oncorhynchus masou* (Brevoot)
(15) *Oncorhynchus masou macrostoma* (Günther)
(16) *Oncorhunchus rhodurus* Jordan et McGregor
2) Genus *Salvelinus*
(17) *Salvelinus fontinalis* (Mitchill)

(18) *Salvelinus leucomaenis* (PALLAS)
(19) *Salvelinus pulvius* (HILGENDORF)
[20] *Salvelinus malma* (WALBAUM)
[21] *Salvelinus malma curiles* (PALLAS)
(22) *Salvelinus miyabei* OSHIMA

3) Genus *Salmo*
(23) *Salmo shasta* JORDAN

4) Genus *Hncho*
(24) *Hucho perryi* (BREVOOT)
[25] *Hucho taimen* (PALLAS)

[5] Family Plecoglossidae
Genns *Plecoglossus*
(26) *Plecoglossus altivelis* TEMMINCK et SCHLEGEL

[6] Family Thymallidae
Genus *Thymallus*
[27] *Thymallus jaluensis* MORI

[7] Family Osmeridae
1) Genus *Osmerus*
(28) *Osmerus dentex* STEINDACHNER
2) Genus *Spirinchus*
(29) *Spirinchus lanceolatus* (HIKIDA)
3) Genus *Hypomesus*
(30) *Hypomesus olidus* (PALLAS)

II Suborder CYPRINODONTES
[8] Family Cyprinodontidae
Genus *Aplocheilus*
(31) *Aplocheilus latipes* (TEMMINCK et SCHLEGEL)

[9] Family Poecilidae
Genus *Gambusia*
(32) *Gambusia affinis* (BAIRD et GAIMARD)

III Suborder EVENTHOGNATHI
[10] Family Cyprinidae
(a) Subfamily Acheilognathinae
1) Genus *Pseudoperilampus*
(33) *Pseudoperilampus typus* BLEEKER
2) Genus *Acanthorhodeus*
[34] *Acanthorhodeus guichenoti* (GÜNTHER)
[35] *Acanthorhodeus asmussi* (DYBOWSKY)
[36] *Acanthorhodeus chankaensis* (DYBOWSKY)
[37] *Acanthorhodeus gracilis* REGAN
[38] *Acanthorhodeus tokunagai* MORI
3) Genus *Rhodeus*
(39) *Rhodeus ocellatus* (KNER)
[40] *Rhodeus sericeus* (PALLAS)
4) Genus *Parachilognathus*

(41) *Paracheilognathus rhombea* (Temminck et Schlegel)
[42] *Paracheilognathus coreanus* (Steindachner)
(43) *Paracheilognathus tabira* Jordan et Thompson

5) Genus *Acheilognathus*
(44) *Acheilognathus longipinnis* Regan
(45) *Acheilognathus moriokae* Jordan et Thompson
(46) *Acheilognathus intermedia* (Temminck et Schlegel)
(47) *Acheilognathus limbata* (Temminck et Schlegel)
(48) *Acheilognathus lanceolata* (Temminck et Schlegel)
(49) *Acheilognathus cyanostigma* Jordan et Fowler
[50] *Acheilognathus signifer* Berg
[51] *Acheilognathus himandegus* Günther

9) Genus *Tanakia*
(52) *Tanakia miobuta* (Tanaka)

(b) Subfamily Gobioninae

1) Genus *Ganthopogon*
(53) *Gnathopogon elongatus* (Temminck et Schlegel)
(54) *Gnathopogon elongatus suwae* Jordan et Hubbs
(55) *Gnathopogon caerulascens* (Sauvage)
(56) *Gnathopogon biwae* (Jordan et Snyder)
(57) *Gnathopogon japonicus* (Sauvage)
(58) *Gnathopogon gracilis* (Temminck et Schlegel)
[59] *Gnathopogon tsuchigae* Jordan et Hubbs

2) Genus *Sarcocheilichthys*
(60) *Sarcocheilichthys variegatus* (Temminck et Schlegel)
[61] *Sarcocheilichthys sinensis* Bleeker
[62] *Sarcocheilichthys morii* Jordan et Hubbs

3) Genus *Coreoleuciscus*
[63] *Coreoleuciscus splendidus* Mori

4) Genus *Pungtungia*
(64) *Pungtungia hilgendorfi* (Ishikawa)

5) Genus *Hemibarbus*
(65) *Hemibarbus barbus* (Temminck et Schlegel)
(66) *Hemibarbus eristigma* Jordan et Hubbs
[67] *Hemibarbus longirostris* (Regan)
[68] *Hemibarbus labeo* (Pallas)

6) Genus *Belligobio*
[69] *Belligobio mylodon* (Berg)

7) Genus *Pseudorasbora*
(70) *Pseudorasbora parva* (Temminck et Schlegel)
(71) *Pseudorasbora parva pumila* Miyadi

8) Genus *Abbottina*
(72) *Abbottina psegma* Jordan et Fowler
[73] *Abbottina rivularis* (Basilewsky)

9) Genus *Pseudogobio*

(74) *Pseudogobio esocinus* (TEMMINCK et SCHLEGEL)

10) Genus *Biwia*

(75) *Biwia zezera* (ISHIKAWA)

(c) Subfamily Leuciscinae

1) Genus *Zacco*

(76) *Zacco platypus* (TEMMINCK et SCHLEGEL)

(77) *Zacco temminckii* (TEMMINCK et SCHLEGEL)

[78] *Zacco pachycephalus* (GÜNTHER)

2) Genus *Opsariichhtys*

(79) *Opsariichthys uncirostris* (TEMMINCK et SCHLEGEL)

(80) *Opsariichthys bidens* GÜNTHER

3) Genus *Tribolodon*

(81) *Tribolodon hakonensis* (GÜNTHER)

4) Genus *Phoxinus*

(82) *Phoxinus steindachneri* SAUVAGE

(83) *Phoxinus steindachneri yamamotis* SAUVAGE

[84] *Phoxinus lagowskii* (DYBOWSKY)

[85] *Phoxinus percnurus* (PALLAS)

[86] *Phoxinus percnurus sachalinensis* BERG

[87] *Phoxinus semotilus* (JORDAN et STARKS)

[88] *Phoxinus oxycephalus* (BLEEKER)

5) Genus *Leuciscus*

[89] *Leuciscus waleckii* (DYBOWSKY)

6) Genus *Aphyocypris*

(90) *Aphyocypris chinensis* GÜNTHER

7) Genus *Ctenopharyngodon*

(91) *Ctenopharyngodon idellus* (CUVIER et VALENCIENNES)

8) Genus *Ischikauia*

(92) *Ischikauia steenackeri* (SAUVAGE)

9) Genus *Hemigrammocypris*

(93) *Hemigrammocypris rasborella* FOWLER

(d) Subfamily Cyprininae

1) Genus *Carassius*

(94) *Carassius carassius* LINNAEUS

(95) *Carassius carassius* LINNAEUS var. "Tetugyo"

(96) *Carassius carassius auratus* LINNAEUS. Goldfish

2) Genus *Cyprinus*

(97) *Cyprinus carpio* LINNAEUS

(98) *Cyprinus carpio* LINNAEUS × *Carassius carassius* LINNAEUS

(e) Subfamily Hypophthalmichthynae

1) Genus *Hypophthalmichthys*

(99) *Hypophthalmichthys molitrix* (CUVIER et VALENCIENNES)

2) Genus *Aristichthys*

(100) *Aristichthys nobilis* (RICHARDSON)

〔II〕 Family Cobitidae

1) Genus *Leptobotia*

〔101〕 *Leptobotia manchurica* Berg

2) Genus *Hymonophysa*

(102) *Hymenophysa curta* (Temminck et Schlegel)

3) Genus *Misgurnus*

(103) *Misgurnus fossilis anguillicaudatus* (Cantor)

〔104〕 *Misgurnus fossilis decemcirrosus* (Basilewsky)

〔105〕 *Misgurnus fossilis fossilis* Linnaeus

4) Genus *Lefua*

(106) *Lefua echigonia* Jordan et Richardson

(107) *Lefua nikkonis* (Jordan et Fowler)

(108) *Lefua costata* (kessler)

5) Genus *Cobitis*

(109) *Cobitis taenia* Linnaeus

(i) *Cobitis taenia taenia* (Linnaeus)

(ii) *Cobitis taenia striata* Ikeda

(iii) *Cobitis taenia biwae* Jordan et Snyder

(110) *Cobitis delicata* Niwa

〔111〕 *Cobitis multifasciata* Wakia et Mori

〔112〕 *Cobitis rotundicauda* Wakia et Mori

6) Genus *Nemachilus*

(113) *Nemachilus barbatulus toni* (Dibowsky)

IV Suborder APODES

〔12〕 Family Anguillidae

Genus *Anguilla*

(114) *Anguilla japanica* Temminck et Schlegel

(115) *Anguilla mauritiana* Bennet

V Suborder SYNENTOGNATHI

〔13〕 Family Hemirhamphidae

Genus *Hemirhamphus*

(116) *Hemirhamphus kurumeus* (Jordan et Starks)

VI Suborder Acanthopterygii

(I) Percesoces

〔14〕 Mugilidae

1) Genus *Mugil*

(117) *Mugil cephalus* Linnaeus

〔118〕 *Mugil carinatus* Cuvier et Valenciennes

2) Genus *Liza*

〔119〕 *Liza parva* Oshima

(120) *Liza haematocheila* (Temminck et Schlegel)

(II) Labyrinthini

〔15〕 Ophicephalidae

Genus *Channa*

(121) *Channa argus* (Cantor)

(122) *Channa maculata* (Lacépede)

[123] *Channa asiatica* (Lacépede)

[16] Family Anabatidae

Genus *Macropodus*

(124) *Macropodus chinensis* (Bloch)

(III) *Percomorphi*

Scombroidei

[17] Family Leiognathidae

Genus *Leiognathus*

(125) *Leiognathus nuchalis* (Temminck et Schlegel)

Percoidei

[18] Family Centrarchidae

Genus *Micropterus*

(126) *Micropterus salmoides* (Lacépede)

[19] Family Kuhlidae

Genus *Kuhlia*

(127) *Kuhlia marginata* (Cuvier et Valenciennes)

[20] Family Cerranidae

(a) Subfamily Oligoninae

Genus *Lateolabrax*

(128) *Lateolabrax japonicus* (Cuvier et Valenciennes)

(b) Subfamily Epinephelinae

1) Genus *Coreoperca*

(129) *Coreroperca kawamebari* (Temminck et Schlegel)

(130) *Coreoperca herzi* Herzenstein

2) Genus *Siniperca*

[131] *Siniperca shautsi* Basilewsky

[132] *Siniperca scherzeri* Steindachner

[21] Family Sparidae

Genus *Sparus*

(133) *Sparus swinhonis* Günther

[22] Family Theraponidae

Genus *Therapon*

(134) *Therapon oxyrhynchus* (Temminck et Schlegel)

(135) *Therapon jarba* (Forskal)

(IV) Gobioidei

[23] Family Gobiidae

(a) Subfamily Eleotrinae

1) Genus *Mogurnda*

(136) *Mogurnda obscura* (Temminck et Schlegel)

2) Genus *Eleotris*

(137) *Eleotris oxycephala* Temminck et Schlegel

[138] *Eleotris swinhonis* Günther

(b) Subfamily Gobiinae

1) Genus *Gobius*

(139) *Gobius similis* (GILL)
(140) *Gobius fusus* RUPPEL
(141) *Gobius gymnauchen* BLEEKER
(142) *Gobius giurinus* RUTTER
(143) *Gobius pflaumi* BLEEKER
[144] *Gobius candidianus* (REGAN)
[145] *Gobius formosanus* OSHIMA

2) Genus *Glossogobius*
(146) *Glossogobius biocellatus* (CUVIER et VALENCIENNES)
(147) *Glossogobius brunneus* (TEMMINCK et SCHLEGEL)

3) Genus *Chaenogobius*
(148) *Chaenogobius annularis urotaenia* (HILGENDORF)
(149) *Chaenogobius isaza* TANAKA

4) Genns *Acanthogobius*
(150) *Acanthogobius flavimanus* (TEMMINCK et SCHLEGEL)
(151) *Acanthogobius ommaturus* (RICHARDSON)
(152) *Acanthogobius lactipes* HILGENDORF

5) Genus *Tridentiger*
(153) *Tridentiger obscurus obscurus* (TEMMINCK et SCHLEGEL)
(154) *Tridentiger trigonocephalus* (GILL)

6) Genus *Pterogobius*
(155) *Pterogobius elapoides daimio* (JORDAN et SNYDER)

7) Genus *Chaeturiichthys*
(156) *Chaeturiichthys sciistius* JORDAN et SNYDER
(157) *Chaeturiichthys hexanema* BLEEKER

8) Genus *Chasmichthys*
(158) *Chasmichthys dolichognathus* (HILGENDORF)

(c) Subfamily Periophthalminae
Genus *Periophthalmus*
(159) *Periophthalmus cantonensis* (OSBECK)

(d) Snbfamily Sicyodiaphinae
Genus *Sicyopterys*
(160) *Sicyopterys japonica* TANAKA

(e) Subfamily Trypaucheninae
Genus *Trypauchen*
(161) *Trypauchen vagina microcephalus* BLEEKER

(*To be continued*)

金魚に於ける再生鱗の形態の變遷

鈴　木　　亮

（愛知學藝大學生物學教室）

The change in the structure of regenerated scales of goldfish

Ryo Suzuki

(Department of Biology, Aiti Gakugei University)

緒　　言

金魚の再生鱗については、森（1930, '31）が側線鱗並に側線器官を實驗的に再生せしめ、特にその形成初期の經過について組織學的に研究しており、小林（1938, '51）はフナ、金魚、鐵魚の自然並に實驗的再生鱗について記載し、これの形態の系統學的價値について論じ、又崎山（1943）もフナの鱗を實驗的に再生せしめて、正常鱗との構造を比較している。尙又小林（1951）はこの魚の再生鱗に於ける中心部の網狀をなし、從來放射線 Radii と呼ばれた構造はこれを溝條 Grooves と呼ぶことが適當であるとする理由の一つにしている。W. Wunder（1949）も金魚、コイ、フナの鱗を實驗的に再生せしめ、正常鱗との構造を比較し、尙再生鱗は、多年の後にも、正常鱗と識別が可能でめることを記載している。

しかるに筆者は 1950 年 11 月より、フナの全身の鱗について形態學的研究をしていたところ、時々再生鱗が見つけられたが、フナの再生鱗は金魚のそれによく似ていて、溝條が中心部に於て廣い網狀連絡を作り、小林（1951）の所謂中心部網狀溝條 Focal network grooves をなすが、筆者は觀察中この構造にも色々の程度があつて、或るものは網狀連絡が非常に小さく、更にわずかのものは連絡のないものさえ見つかつた。即ち再生鱗であるか正常鱗であるか明確に區別のつけ難いものが多數現われた。そこで再生鱗は、時日が經つと遂には正常鱗と見分けがつかない原形にまで復歸するのではないかとの疑問を持ち、1951 年5月より金魚を用いて再生實驗に着手したものである。そして遂に予期した如き結果を確認することができたのでここに報告する次第である。

材料及び実驗方法

實驗には体長 7.0～11.0cm で滿1ヶ年から2年位の飼育し易い和金を用いた。實驗中、正常鱗との區別を明確にするために、左側の鱗を先の細いピンセットで全部剝離し、供試材料は 10 尾を用いたが、途中手術により死亡して最後には4尾が殘つただけである。個体の識別には鰭を鋏で切り取り、切り取つた後の鰭が再生された時は、識別のわからなくならない中に幾度か同じように切つては目じるしとした。飼育池は横 130cm, 縦 50cm, 水深 40cm の水槽に飼育し、時々すくい揚げては、再生された鱗を觀察した。

觀察と結果

鱗は5月から8月に於ては既に4日目に不完全な鱗が形成され、ピンセットで容易に剝離出來るが、未だこの頃は隆起線の形成は見られず、不規則な非常に數の多い溝條が鱗のまわりに現はれ、鱗の大部分が網目狀であつて、一見細胞の如く、各網目の中心には核狀の形態が見られる。（Fig. 1の1）この頃の鱗は、未だ全く不完全であつて、肉眼では透明に見え、しかも非常にやわらかく、これを一晝夜水中に放置すれば容易に溶解される。從つてこの頃ではまだ、鱗の前後の區別は明らかでなく、大きさも附近の正常鱗に比べて小さい。又色素顆粒もできていない。しかし 11 月から

12月における實驗では、この狀態まで再生せしめるに少くとも1ヶ月を要した。夏期に於ては剝離後 15 日で既に隆起線が觀察される。即隆起線は鱗の周邊部より、鱗全体に存在する網狀溝條が、周邊部より次第に消失すると同時に現はれて來る。

剝離後 42 日目の觀察では、既に隆起線が 15～20 本現われ、溝條の數が次第に少くなる。(Fig.

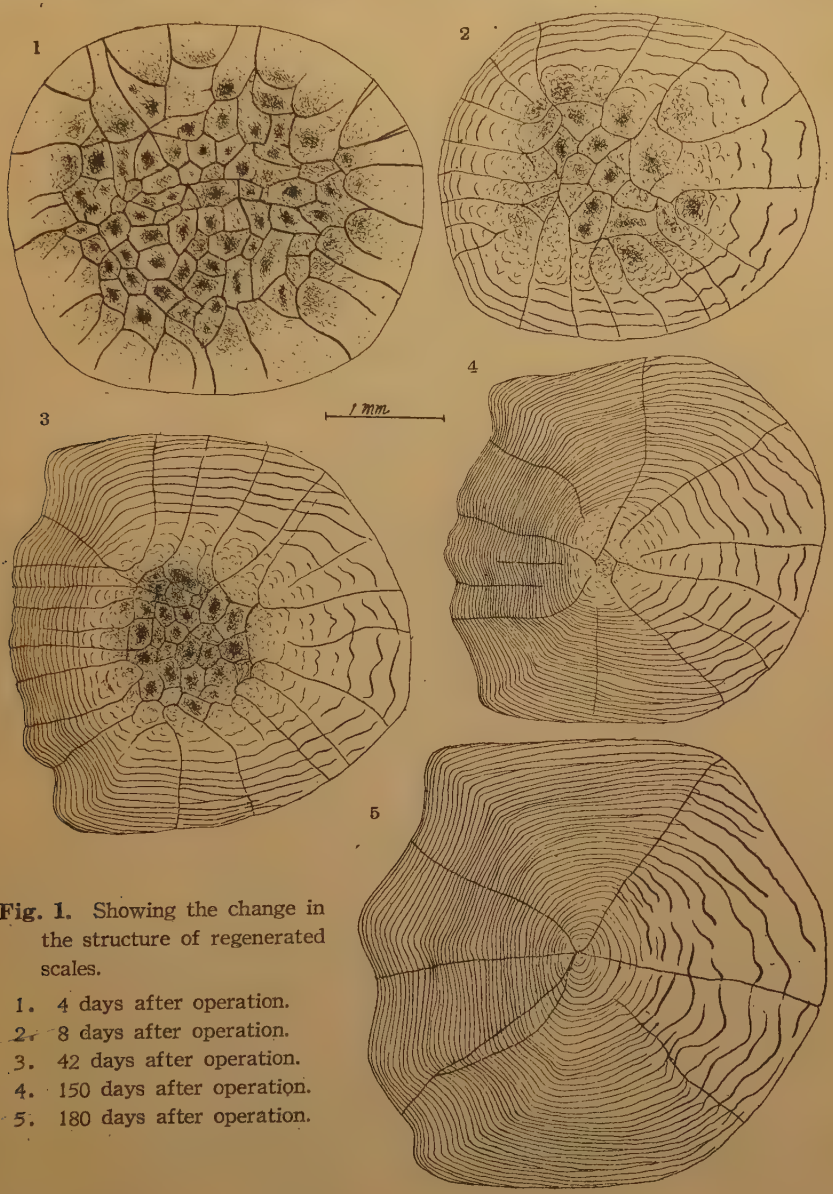

Fig. 1. Showing the change in the structure of regenerated scales.

1. 4 days after operation.
2. 8 days after operation.
3. 42 days after operation.
4. 150 days after operation.
5. 180 days after operation.

1の3) 再生鱗の發育速度が個体によつて多少差があつたために、表に示したのは2個体についての平均値で、各平均値は、 15～50 枚の鱗のものの平均である。 42 日後のものでは前後が明らかに區別でき、完全な再生鱗の形態を整へている。しかし冬期における實驗では、再生速度が非常におそく、42日の觀察では隆起線も未だ8本程度現はれただけで、網狀溝條が鱗の大部分をしめていた。

溝條並に隆起線の數は、1個体の魚においても採取場所によつていちぢるしく異るため、なるべ

く体側中央部の側線より上下4行までのものを用い、体側の前方及後方（4列）の鱗は平均値を求める資料とはしなかつた。色素顆粒は再生鱗の發育とともに次第に增加して來るが、崎山（1943）はフナに於ては正常鱗と再生鱗と色素細胞の形態が異ることを報じているが、筆者の實驗に於ては両者に差異を認めることばできなかつた。

150 日になると、約半數の鱗が、網狀溝條を消失する。殘つていても網目がわずか1ヶか2ヶ位である。それに反して隆起線の數は增加し、 25～50 本位になる。然しまだ再生鱗の痕跡を殘し、中心部には隆起線の未發達の部分があり、顆粒狀の物質を殘存している。（Fig. 1の4） この頃は既に 10 月になつているため再生速度が減じ、かなりの日數を要した。

森（'30）は又正常鱗を半截しても、その半截部が再生されることを報じているが、筆者もこれと同ようの結果を得、半截した場合にも、初期の再生部は網狀構狀を呈し溝條の數が多く隆起線が認められない。しかし時日が經過するに從つて網狀構狀が周邊部より消失すると同時に隆起線が形成されて來た。さらに溝條も數を減じ、半截以前に存在していた溝條に次第に連結するに至つた。さらに溝條の數も減じて正常鱗に近い價が得られた。（Table 1）これ等の鱗では最早溝條や隆起線の數を細密に觀察しなくては、その外形だけでは再生鱗であるか、正常鱗であるかの區別はつけ難い。

Table 1. Comparisom of the average number of grooves and ridges in regenerated and ordinary scales.

No.	Struct.	Date				
		6～9days	42days	150days	180days	Ordinary scales
3	Grooves number	25.4	21.7	15.4	—	9.7
	Ridges num.	4.1	19.6	48.0	—	79.9
5	Grooves num.	23.7	—	10.9	10.6	10.0
	Ridges num.	4.6	—	29.0	67.5	79.5

考 察

以上筆者は、最短180日間で再生鱗が殆んど正常鱗と區別がつき難くなるまでに追求することができたのである。筆者が先に述べた如く、フナの鱗に於ても、再生鱗と正常鱗との區別のつけ難いものがあることは、自然に於ても、鱗が何等かの傷害により離脫された場合でも、半ケ年か1ヶ年位で全く正常鱗と區別できないまで再生されるものと推察している。

初期の再生鱗に溝條の數の多いことは既に記述した通りであるが、筆者の觀察によるとこの數多い溝條にも不完全なもの、即溝條の巾が非常に狹く、又中心部網狀溝條より鱗の周邊まで完全に到達していないものが多く見うけられた。更に中心部網狀溝條も、完全なる網目を呈しておらず、破損して、縺れたような觀を示しているものがある。この事からして、不完全なる溝條及び網狀溝條から次第に時日の經過とともに消失し、溝條の數が減じるのであると推察している。

要 約

(1) 本研究は金魚の鱗を剝離及び半截して、殆んど正常鱗と區別できなくなるまでの經過を追求したものである。

(2) 初期の再生鱗は、溝條が多く、隆起線が少いが、正常鱗に近ずくに從つてこの關係は逆になる。

(3) 再生の速度は、季節によつて異り、夏期は早く、冬期はおそい。

(4) この研究の結果から魚類の再生鱗は全て再生された初期は、正常鱗と著しく形態を異にするが、發育が進むに從つて正常鱗の形態に次第に近づき、終には全くこれと區別できなくなるものだと推測せられる。

終りに臨み、この研究については愛知學藝大學助教授小林久雄先生の御指導並に御校閲を賜つたことを銘記して、厚く感謝の意を表する次第である。

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Résumé

The change in the structure of regenerated scales was pursued in this study, which were formed where all the scales on one side of the body were taken off with a pincette.

In regenerated scales in the early stage of regeneration, grooves, which form network, are spread all over the scale, and ridges are not observable yet. As regeneration goes on, network grooves gradually disappear from around the circumference of scales and radial grooves decrease in number, while ridges increase in number by degrees; then the scales gradually come nearer to the structure of ordinary scales, until at last they are utterly indistinguishable from ordinary ones, in the shortest period of 180 days.

When a half of each scale is cut off with scissors, the part cut off is soon regenerated, where many grooves are formed in the early stage and ridges are not seen, but as days pass, grooves decrease in number, while ridges increase in number.

The speed of regeneration varies as the season changes; it is fast in summer, the scales recovering the structure of complete regenerated scales in about 15 days, and slow in winter, at least in more than a month.

According to this study, it is supposed that regenerated scales, in the early stage of regeneration, are all strikingly different in structure from ordinary ones, but that as they go on growing, they come nearer to the structure of ordinary scales to be finally indistinguishable from them.

コイ及びフナにおける頭骨片名の査定に就いて

高　橋　仁　助
（熊本大學教育學部）

Revision of the names of head bones of *Cyprinus carpio* and *Carassius auratus*

Nisuke TAKAHASI
(Fac. Education, Kumamoto, Univ.)

緒　言　コイ及びフナは最も入手し易く、且、頭骨片の縫合緩除で、初學者の解剖實習用材料としては最適のものの一つである。然るに其等の骨骼を題材とした外語の書籍は極めて少なく、筆者の知る範圍では僅にS. Ray LANKESTER の編輯にかかる A treatise on zoology 位のものであると言つても過言ではないようである。反之、其等に關した邦語の圖書は割合に多い。例えば、實驗動物學（五島清太郎著、合田得輔校訂、フナの圖解と記載）、動物實驗の指針（岡村周諦著、コイの圖解と記載）、日本動物解剖圖說*（池田嘉平監修、廣島文理大學博物學會著、コイの圖解）、動物解剖實習スケツチ編（入來重盛著、コイとフナの圖解）、日本淡水魚類（岡田彌一郎、中村守純共著、コイの圖解と記載）動物解剖集成（有元石太郎解說、コイの圖解と記載）の如きである。

然るに此等の圖書に見られるコイ及びフナの篩骨（Ethmoid），鼻骨（Nasal），鋤骨（Vomer），前額骨（Prefrontal），口蓋骨（Palatine）及び楔耳骨（Sphenotic）の圖解及び記載を夫々比較吟味すると、前五骨に關しには五島、岡村、池田、入來及び岡田の五氏の見解は完全に一致しているが、ただ有元氏のみは其れと全く異なる見解を示している。然るに最後の一骨即ち楔耳骨については一方、有元、池田、入來及岡田の四氏の見解は一致しているが他方、五島及び岡村の両氏は前四氏とは全く異なる見解をとつている。これを具体的に云えば、五島博士等（五島、岡村、池田、入來、岡田）が鼻骨と呼稱する骨を有元氏は篩骨と呼び、五島博士等の篩骨を有元氏は鋤骨と、五島博士等の鋤骨を有元氏は口蓋骨と、五島博士等の口蓋骨を有元氏は前額骨と呼稱している。而して五島博士等は前額骨についてはその圖解も記載も省略しているが、有元氏は該骨を立派に圖解記載してその存在を證明している。

又有元氏は五島博士等が省略している一對の微小骨を鼻孔附近に見出して、それを鼻骨と呼んでいる。尙、有元氏外三氏（池田、岡田、入來）が楔耳骨と認定する骨を五島、岡村両博士は基底楔骨（Basisphenoid）と呼稱している。

斯の如くコイ（フナも）の頭骨片の名稱が邦人學者間に一致を缺き、錯綜混乱を極めているが、然し前揭の著書は純然たる學術論文ではないのであるから、筆者は其等を捉えて、今更事新らしく彼此非難攻撃しようとの意志は毛頭ないが、筆者をして敢てこの小文を綴らしむるに至つた理由としては、若し上述の如き不一致を其儘に放置して、五島博士等の見解を容認するならば、1）脊椎動物間における比較骨骼學的体系を根本的に攪乱し收拾のつかぬ混乱に導く虞れあること、2）現在における魚類の分類學的体系を改廢し、新体系を創立せねばならぬような煩雜を招來するに到るべきこと、3）前揭の圖書は何れも皆我國著名の學者達によつて著述せられたものであり、從つて現下の大學生、高中校生徒並に教官諸氏は殆ど皆それによつて學習し或は指導しており、其等の人々はその用書間における頭骨片の名稱の不一致によつて、一方ならず困惑苦慮しつつあること、

* 以下、本書の著者を池田氏として記述す。

4) 教育上好ましからざる事態を招來する處れあること、例えば、筆者は過般學生にコイの解剖實習をなさしめた際に、腦頭蓋（Cranium cerebrale）の前端背側（吻部）にある一不對骨を篩骨として教示したところ、或一學生は五島博士著、合田博士校訂の實驗動物學第二卷と入來博士著動物解剖スケツチ篇とを筆者に示して、その不對骨を篩骨と呼稱するは誤である、五島博士も入來博士も共にその骨を鼻骨と呼んでいるではないかと詰めよつて、容易に筆者の說明を肯定せんとはしなかつたと云う事實がある。

以上のような情況下にあるので、筆者はこの際這般の事情を廣く讀者諸賢に訴えて、その御協力を仰ぎ、前揭圖書間の不一致を調整解除しようと企て、先ず自ら內外圖書を涉獵し、同時に各種脊稚動物の頭骨の比較研究を行い、それに基いて前記頭骨片の名稱の査定を試みた。其結果として、五島博士等の所見とは全く異なり、有元氏の見解と完全に一致する結論に到達するに至つた。以上は筆者が玆に淺學不才をも顯ず、此拙文をものした動機及び目的であるが、その考察結論に關しては或は大なる過誤を犯しているやも測られないから、讀者諸賢におかれては、筆者の微意のあるところを御憐察下さつて、御遠慮なく御叱正の勞を賜りますよう切に御願申し上げます。尙又、諸先生方の御高著に對し、彼此批評がましいことや、反對意見を申し上げました失禮の儀は何卒御寬容下さいますよう重々御願申し上げます。

次に彼此比較の便宜上、五島博士はフナ、岡村博士がコイについて爲された篩骨、鼻骨、鋤骨、前額骨、楔耳骨及び口蓋骨の記載を原文の儘轉載併記し、其後に同魚における其等諸骨について筆者の見解を述べようと思う。因に本文中に用いた骨名中、外國名は STARKS の Synonomy of the fish skeleton に、邦名は主として有元氏の記載によつた。しかし次に揭げる五島、岡村及び有元の三氏の原文中の骨名は原文の儘にしておいた。

1. 篩　骨 (Plate I, Fig. A. 1)

五島：前記並蝶骨の擴張部の先端には一箇の略ぼT字形の骨あり是れ即ち篩骨なり。

岡村：並蝶骨の前にはその前端を被ふ略Y字狀の骨あり之れを篩骨と稱す。其Y字狀の先端は口の背壁の前部を形成す。

有元：頭骨背面の最も前方にある骨にして中篩骨、外篩骨の愈合して成れるものなり。

高橋：本骨は楯形の不對骨で、軀部と柄部とより成る。軀部は略ぼ不等邊五角形の廣い薄板で鼻腔の背壁をなし、柄部は軀部の腹面正中線に沿うて發達する少しく側壓された分厚い骨板で、左右両鼻腔の中隔をなす。

本骨は軀部を背方に、柄部を腹方にして、腦頭蓋の背側最前端の正中線に位し、軀部は其前尖端（五角形の頂角）を前方に向け、自由端として終るも、其後緣（五角形の底邊）は額骨（Frontal）の前緣に接着す。柄部は其腹緣を鋤骨の背側に、其後緣を前額骨の內（前）緣に接着す。柄部の前部側面には口蓋骨を吊り下げる靱帶の附着する淺き小窩あり。

本骨は魚種により著しくその形狀大小を異にす。例えばマスにおいては其軀部が廣く長い骨板であるが、スズキにあつては、それが柄部の後端背側に接着する微小なるY又はV字形の骨片にすぎない。又タイ其他多くの硬骨魚にあつては、該部は全く退化消失して全背緣が稜峯狀を呈する柄部のみとなる。

五島博士等は本骨を鼻骨（Plate I–II, Figs. B, C, D, E. 2）と認定しているが、本骨は不對骨なること、左右両鼻腔の中隔をなすこと、左右嗅神經によつて夾まれること、鋤骨と接着すること、その後部が左右の前額骨間に接着介在すること等より觀て鼻骨でなく篩骨であることが明かである。

2. 鼻 骨 (Plate III, Fig. F)

五島: 背側に於て左右の鼻孔の間には一箇の方形の扁平骨あり是れ即ち鼻骨なり元來左右に對立せるもの互に固着せり。

岡村: 前額骨 (高橋註、Frontal の謂) の前において両鼻孔の間にある一箇の扁平方形にして先端の突出せる骨を鼻骨といふこれ左右のものが固着して一箇となれるものなり。

有元: 鼻孔の後緣に附着する極めて小なる骨なり。

高橋: 本骨は極めて微小な對骨で、体長 30cm のコイにあつても、その大きさは僅に 幅 1mm, 長さ 6mm～幅 1.5mm, 長さ 6mm にすぎない。

本骨は鼻孔の背内側、額骨の前端、篩骨の軀部の後外緣に接して、長軸を前後にして存在し、僅に皮膚組織によつて、其固有位置を保持するに過ぎない。

五島博士等は本骨 (有元及び高橋が鼻骨と認定する骨) につきては何等示すところがないが、有元氏は本骨を鼻骨と認めて上記の如く記載している。本骨は對骨なること、鼻孔、篩骨、額骨に對する諸関係より觀て、鼻骨と認定すべき骨であることは明白である。しかし五島博士等の所謂鼻骨 (Plates I-II, Figs. B, C, D, E. 2) とは全く同名異物であつて、同博士等の所謂鼻骨は實は篩骨であつて本骨ではない。

3. 鋤 骨 (Plates I-II, Fig. A. 8)

五島: 翼狀骨の前端に関接する所の不規則形の骨は即ち鋤骨なり。

岡村: 篩骨の前端の分叉せる部分の背面に接し、鼻腔の前壁の一部分を成し、表部より三叉枝狀に見ゆる骨を鋤骨と云う、其一枝は翼狀骨の前端に関接す、この骨の背面には一小突起を有し、又腹面には長き一枝ありて、腹方に向い、篩骨の前端の後側を擁す、両側の鋤骨は鼻骨の前端の突起を左右より夾む。

有元: 頭骨腹面の最前方なるY字形の骨は即ち鋤骨なり。

高橋: 本骨はY字形の骨で、其叉狀に分れた頭部を前方に、扁平細長な尾部を後方に向けて腦頭蓋の腹側最前端、篩骨の腹側、口蓋の正中線上に位置する不對骨である。本骨の背側の前部は篩骨の柄部と、同じく中部は前額骨の内腹端と、同じく後部は副楔骨 (Parasphenoid) の前端腹側と接着するも、腹側は全部に渉り自由で、口蓋の一部を成す。本骨の頭部はその各頂端に接して横斷亀裂を有し短小なる一箇の上生骨を分生す。この上生骨の上には短小なる前鼻骨 (Prenasal) が載つている。

本骨は五島博士等によつて篩骨 (Plates I-II, Figs. B, C, D, E. 1) と呼稱せられているが、本骨は鼻腔の中隔をなさざること、篩骨の直腹下に位すること、副楔骨の前端に接着すること、口蓋骨を腦頭蓋下に垂下する支持骨なること、腦頭蓋の最前部正中線上に位して、口蓋の形成にあずかること、魚類分類學者が本骨上の齒を鋤骨齒 (Vomerine teeth) と呼びなしていること等より觀て篩骨でなく、鋤骨であることは明白である。

4. 前 額 骨 (Plates I-II, Fig. A. 9)

五島: ——

岡村: ——

有元: 篩骨と額骨との背面の境より左右の腹方に突起せる骨なり。

高橋: 本骨は一箇の鋭角を有する三角形の對骨で、その鋭角より成る遠体部は自由端として外方に突出するも、廣濶なる近体部 (三角形の底部) は額骨の前緣、篩骨の柄部の後緣、鋤骨の後背側

副楔骨の前背側、眼窠楔骨（Orbitosphenoid）の前緣に接着し、眼窩の前壁及び鼻腔の後壁をなす。嗅神經通孔は本骨の近体部、篩骨との接着緣に接近して存在す。

五島博士等は本骨を口蓋骨（Plates I–II, Figs. B, C, D, E. 20）と呼稱しているが、本骨は腦頭蓋に堅く接着してその一部をなすこと、Palato-pterygo-quadrate 連鎖の構成要素ならざること、嗅神經通孔の存在すること、分類學者が口蓋骨齒（Palatine teeth）と呼ぶは、本骨上に發達した齒でなく、後述の口蓋骨上の齒であること等より觀て、本骨は口蓋骨でなく、前額骨であると言明することができる。

5. 楔 耳 骨 (Plates I–II, Figs. A, C, E. 16)

五島：——

岡村：——

有元：前耳骨と翼楔骨との中間において背側に接し左右に突出す。

高橋：本骨は極めて複雜なる形狀を呈する對骨であつて、其位置は額骨の後外側下、翼耳骨（Pterotic）の前外側下、翼楔骨の背後緣、前耳骨（Prootic）の背緣にあり。而してその一部は翼楔骨、前耳骨及び翼耳骨と共に舌顎骨（Hyomandibular）の背端を受容する大なる関接窩を形成す。

本骨は五島博士と岡村博士とによつて基底楔骨（Plates I–II, B, D. 13）と呼稱せらるるも、腦頭蓋上に前記の位置を占むること、副楔骨との接觸を缺くこと、對骨なること、舌顎骨の背端を関接せしむる関節窩の一部を成すこと等より觀て、基底楔骨でなく、楔耳骨であることは確實である。

6. 口 蓋 骨 (Plate III, Fig. A 20)

五島：眼窩の前端に於て並胡蝶骨と篩骨との縫合線より左右に突出し鼻腔の腹壁及び眼窩の前壁の一部分を形成する骨あり是れ即ち口蓋骨なり。

岡村：眼窩の前壁の一部分、鼻腔の腹壁等をなし、左右のものは並胡蝶骨の前部をその間に夾み前方には外側に突出部ある略三角形の骨を口蓋骨と稱す。

有元：翼狀骨の前端に接する棒狀の小骨なり。

高橋：本骨は前後に長く、其前後両半部は少しく上反し、中央部は僅に窪み、側方より觀れば恰も西洋鞍狀を呈する對骨である。骨体の中央部の左右には翼狀に張り出した顯著なる三角形突起あり。本骨はその前半部を以て鋤骨の叉狀頭端及び前鼻骨に関接し、その後半部の後端を以て中翼狀骨（Mesopterygoid）の前端に関接す。尙、中央部より内方に張り出した翼狀突起は、靱帶によつて篩骨の柄部に連結せらる。

本骨は Palato-pterygo-quadrate 連鎖の一要素として上顎骨（Maxillary）の内側、篩骨の外側鼻腔の前腹側、前額骨の直前に位置し、その前半を以て鋤骨、前鼻骨に關接し靱帶によつて篩骨に繫着し、Palato-pterygo-quadrate 連鎖を腦頭蓋に懸垂せしむ。

五島博士等は本骨を鋤骨（Plate III, Figs. B, C, D. 8）と認定しているが、本骨は對骨なること、篩骨と直接に接着せぬこと、腦頭蓋の構成にあずからざること、Palato-pterygo-quadrate 連鎖の一構成要素として、臟頭蓋（Cranium viscerale）系に屬する骨片なること、魚類分類學者は本骨上にある齒を口蓋骨齒（Palatine teeth）と呼び、それに分類學上の重要價値をみとめ、その有無によつて分類を行つていることなどから觀て、本骨は鋤骨でなく、口蓋骨であることが確實である。

考　　察

以上は筆者が内外の文献を左手に、種々の脊椎動物の骨骼を右手にして、彼此比較研究をしても

たらし得た成果であるが、各骨片の形狀其他に關する表現記載に至つては難澁不備の点が多々ありと思う。しかしコイにおける前述の篩骨、鼻骨、鋤骨、前額骨、楔耳骨及び口蓋骨の六骨片の腦頭蓋に對する位置的關係並に各隣骨片との關係は、コイ（フナにも）に特有なものでなく、普通一般の硬骨魚にも殆ど同一狀態において觀察せられるものである。換言すればコイ（フナも）における上記の骨片の腦頭蓋に對する位置的關係は、硬骨魚の頭骨に共通な組織で、何種にあつても大同小異である。

實にこの事は次に示す東京帝大農學部紀要第八卷第三號中にある、岸上博士のサバ型魚類の頭骨の記載を見ても亦、田中博士がその著日本魚學中に Starks に據るスズキ類（*Perca*）の頭骨圖と共にかかげている記述を吟味して見ても容易に肯定し得る事實である。即ち此等兩博士の記載の要所を摘出轉載すれば次の通りである。

"The ethmiod is a median bone, bounded by the frontals above, by the prefrontals at the lateral and posterior sides, and by the vomer and parasphenoid below. ……The vomer is an anterior median bone, thickened at the anterior end, but gradually attenuated behind. The bone lies below the parasphenoid, and is jointed to it at the posterior part, at the anterior part it is jointed to the ethmoid and prefrontals with suture.……The nasals are more or less elogated flat bones, firmly jointed to the antorior margin of the frontals, and the anterior end of these bones rests on the palatines.……The prefrontals are paired bones, formeng the anterior wall of the orbit, and lies between the vomer, parasphenoid, ethmoid, and the anterior part of the frontals.……The olfactory nerve passes through the middle of the prefrontal. …… The sphenotics form a part of the lateral wall of the optic lobe, and at the same time a part of the dorsal wall of the optic cavity, externally they are a part of the articulating facet for the antarior head of the hyomandibular, moreover forming the postorbital ridge. The sphenotics are bounded externally by the frontals, alisphenoid, prootics, pterotics, parietals, and epiotics, and internally by frontals, alisphenoids, prootcs, supraoccipital, and sometimes epiotics. …… The basisphenoid is the smallest cranial bone, Y-shaped, median in position, and lies between the prootics and alisphenoids on the cranial floor. The median vertical process is laterally compressed, and is united to the parasphenoid, thus dividing the mouth of the myodome into two. …… The palatine lies on the external side of the vomer and holds the head of the maxifllary fast, with bent and nearly bifurcated anterior end." (岸上博士)。

"……。斯の如き頭骨は極めて堅く結合せるものにして剝離し易からず、其前端、背中線にありて同時に口蓋の前部を成す一骨を鋤骨と云ひ、篩骨は其後方背中線にある一骨にして此骨の側方にありて頭の各側に一個あるを前額骨と云ふ。……。額骨の後方にて壁骨の側方にあるを楔耳骨とし……。近楔骨は口蓋の中線にある狹き一骨にして前方は鋤骨に、後方は底後頭骨に接す。此骨の上方にありて前耳骨の前方にあるを底楔骨とし……。体の正中線に向ひ斜に位する骨は數骨ありて下方は篩骨に接し前方は口蓋の一部を成す是等の諸骨を列擧すれば曲顎骨、後翼骨、中翼骨、翼骨、口蓋骨、縫合骨及び方骨是れなり。……。吻の前部にて背中線よりも稍々側方に小骨あり之を鼻骨と云ふ。"（田中博士）

以上縷々のべ來つたような次第であるから、今若し五島博士等のコイ又はフナにおける頭骨片の呼稱を其儘他の硬骨魚の頭骨片に適用するとすれば、同博士等以外の學者の手になる、脊椎動物の

比較解剖學書や魚學書の圖示記載と全く一致しない事實が續出する結果となる。例えば、魚學書によると、スズキは口蓋骨に齒を有するが、五島博士等の所見に從つて、同魚につき口蓋骨齒を檢出しようと努めても、それは全く無効である。如何となれば、同博士等の口蓋骨と呼ぶ骨は、實は無齒の前額骨であるからである。又マスの鋤骨には齒があるが、同博士等によれば、それは鋤骨齒でなく篩骨齒であらねばならない。如何となれば同博士等が鋤骨を篩骨と呼稱しているからである。しかし魚學書には立派にその齒を鋤骨齒と記載している。加之、筆者の知る範圍では、硬骨魚の齒として知られているものは前上顎骨齒、上顎骨齒、下顎骨齒、舌骨齒、鋤骨齒、口蓋骨齒、咽頭骨齒及口蓋骨（palate teeth と呼び、主として中翼狀骨上の齒）の八種のみで篩骨齒とか前額骨齒などと呼稱せらるる齒はない。

尙又、コイ（フナにも）には他の硬骨魚と同樣に、二箇（一對）の鼻骨が明かに實在するが、五島博士等の見解に從えば、鼻骨が三箇存在することなる。如何となれば、同博士等は篩骨を鼻骨と認定しているからである。

以上の通りであるから、今若し五島博士等の頭骨片に關する所見に從つて、硬骨魚の分類を行うとすれば、現在の魚類分類學の体系を根本的に改廢し、新に分類体系を創立せねばならぬ部類が多々現出すると思われる。又五島博士等はフナ又はコイの前額骨を口蓋骨と認定し、前額骨そのものにつきては圖示も記載もしていない。このことは前額骨を口蓋骨と認定した結果、必然的に前額骨と呼稱すべき骨がないことになり、止むなくその圖示も記載も省略するに至つたものか、若しくはコイにもフナにも該骨が缺如するものと誤認した結果であるかわからないが、兎に角に筆者の知る範圍では硬骨魚には必ず前額骨が存在し、しかもその腦頭蓋上における位置は各魚種共全く大同小異である。其故に、コイ（フナも）において五島博士等が、口蓋骨と認定する骨は、實は前額骨であることは一点疑う餘地がないが、然し若し、同博士等の見解をコイ（又はフナ）以外の硬骨魚にまで及ぼすならば、硬骨魚に前額骨が存在せぬこととなる。若し斯くなるならば、現在における硬骨魚の骨骼体系、ひいては高等脊椎動物の骨骼的系統体系を變革せねばならぬような事態に直面するに至るべきは蓋し當然の歸結であると言わなければならない。

而して五島博士等が上述の見解をとるに至つた原因は、筆者の推定を以てすれば、同博士等はコイ（又はフナ）の骨骼調製に際し、微細且つ離散し易い鼻骨を無意識のうちに紛失したことに氣付かず、其儘頭骨片の認定を進めたが、偶々鼻孔附近にある篩骨の軀部が、鼻腔の上壁をなして、恰も普通の硬骨魚の鼻骨を髣髴せしむる狀態にあつたので、それを以て鼻骨と誤認するに至つたものと思われる。而して鼻骨は對骨であるが、篩骨は不對骨であるので、其間の數的不一致を調和する一策として、左右兩鼻骨が互に癒着して、一箇の鼻骨を形成したものとの見解をとるに至つたものであろう。斯くして篩骨を鼻骨と誤認し、續いて篩骨、鋤骨、前額骨、口蓋骨の認定に當つては、その必然の成行として、行き懸り上、其隣接骨を、次々に、即ち鋤骨を篩骨と、口蓋骨を鋤骨と、前額骨を口蓋骨と認定呼稱するの餘義なきに至つたのであろうかと思われる。

以上は全く筆者の想像であつて、果してどの程度の眞實性があるかわからないが、何れにせよ、鼻骨の紛失に氣付かなかつたことが既述のような結果をもたらした最初の過誤であつたことは爭われぬ事實ではあるまいか？

結　　論

以上コイ又はフナの頭骨は他の硬骨魚のそれと殆ど全く同一の機構からなつている。而してその篩骨、鼻骨、鋤骨、前額骨、楔耳骨及び口蓋骨が他の硬骨魚におけると、殆ど全く同一の狀態で實在するものである。そしてコイ又はフナつおける此等の骨片は、たとえ他の硬骨魚の其等と形態的に大なる差異を示すとしても、頭骨上における各骨片に特有な位置は勿論、神經、鼻腔、眼窩、口腔、其

他に對する關係においても亦、大同小異であつて、決して五島博士等が述べるようなコイ又はフナにのみに顯著に存在する特異性を示すものではない。

筆者は種々の硬骨魚の頭骨を比較研究した結果、コイ又はフナにおける頭骨片の呼稱は五島博士等の見解に從うべきものでなく、有元氏の見解に從つて爲さるべきものであると確信する。

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Resumé

The names of head bones of *Cyprinus* and *Carassius*, which are recorded in the books written in Japanese, are in great confusion. That is, the bones described and figured as the ethmoid, vomer, palatine, nasal, and basisphenoid by S. Goto and others are disgnated successively and respectively as the vomer, palatine, ethmoid and sphenotic by I. Arimoto. But as the results of my comparative studies on the skeletons of the various teleostean fishes and other vertebrate animals, it was proved that the

Fig. A

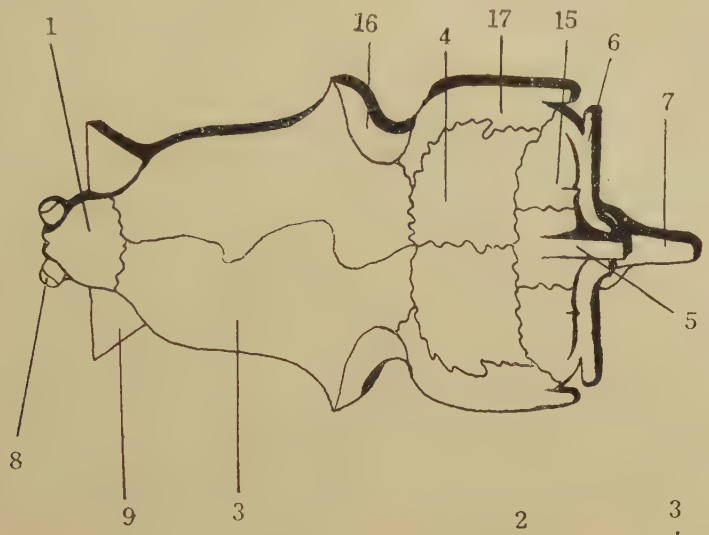


Fig. B

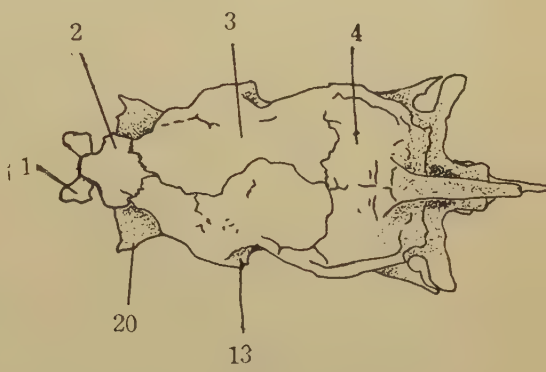


Fig. C

Fig. E

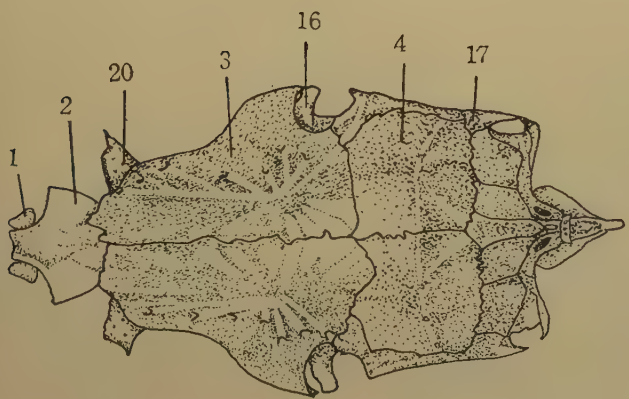


Fig. D

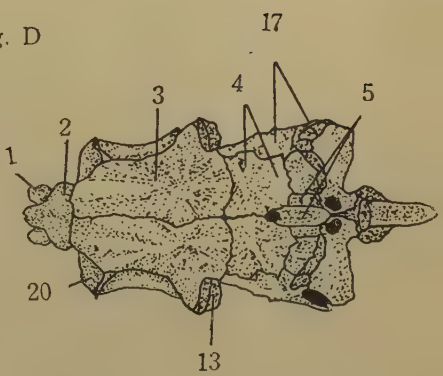


Fig. A

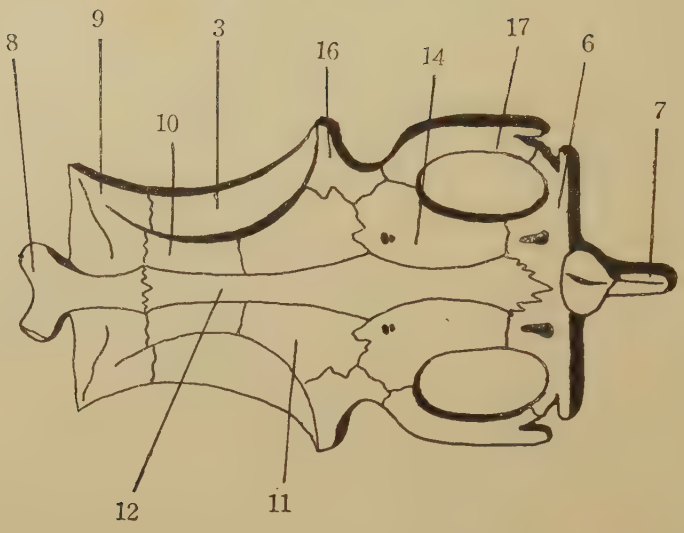


Fig. B

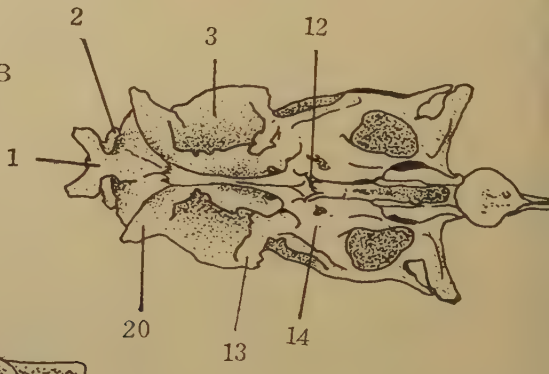


Fig. C

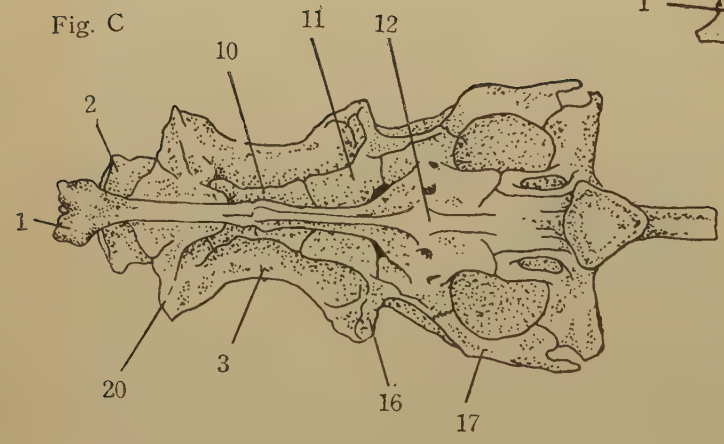


Fig. E

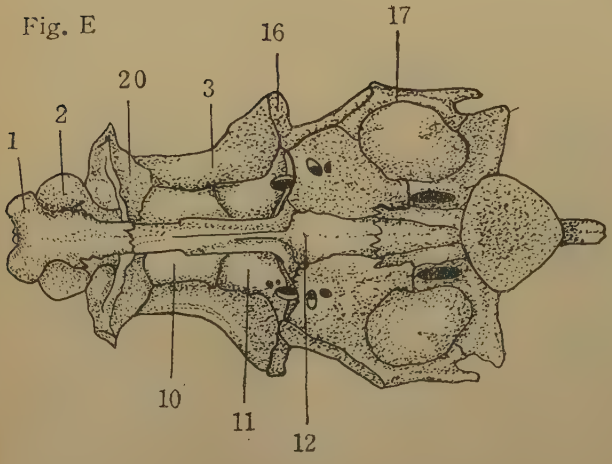
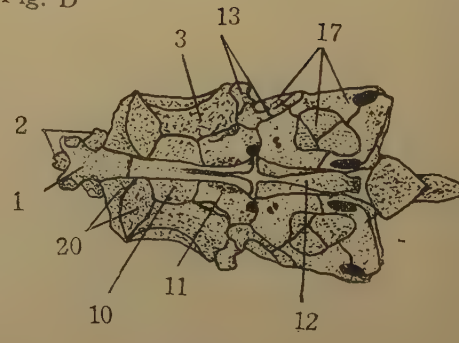


Fig. D



structure of the skull of *Cyprinus* or *Carassius* is essentially similar to that of the other common teleostean fishes; and that the bones called in the names of the nasal, ethmoid, vomer, sphenotic, prefrontal, and Palatine are arranged in nearly the same manner as those of the latter fishes as be ssen in ARIMOTO's book. Therefore, I think that definition of the bones by I. ARIMOTO must be regarded to be quite right, while those by S. GOTO and others should be erased.

附　圖　の　說　明

コイ及びフナの頭骨
第Ⅰ圖版　腦頭蓋背面圖
第Ⅱ圖版　腦頭蓋腹面圖
第Ⅲ圖版　主として臟（顏面）骨の一部の側面圖とコイの鼻骨の背面寫眞
A 圖　有元氏著書より描寫（コイ）
B 圖　五島氏著書より描寫（フナ）
C 圖　入來氏著者より描寫（コイ）
D 圖　岡村氏著書より描寫（コイ）
E 圖　池田氏著書より描寫（コイ）
F 圖　高橋原圖（約8倍廓大）（コイ）
圖に附した頭骨片の番号とそれに該當する頭骨片名（骨名指示は各著者の記載と附圖に準據す）。

骨の番号	當該番号骨の外國名	同左の日本名、括弧内は別名
1	Ethmoid	節骨
2	Nasal	鼻骨
3	Frontal	額骨、(前額骨)、(前頭骨)
4	Parietal	顱頂骨、(頭頂骨)、(壁骨)
5	Supraoccipital	上後頭骨
6	Exoccipital	側後頭骨、(外後頭骨)
7	Basioccipital	基底後頭骨
8	Vomer	鋤骨
9	Prefrontal	前額骨
10	Orbitosphenoid	眼窠楔骨、(眼窠胡蝶骨)
11	Alisphenoid	翼楔骨、(翼胡蝶骨)
12	Parasphenoid	副楔骨、(並胡蝶骨)、(近楔骨)
13	Basisphenoid	基底楔骨、(基底胡蝶骨)
14	Prootic	前耳骨
15	Epiotic	上耳骨
16	Sphenotic	楔耳骨、(胡蝶骨)、(楔狀骨)
17	Pterotic	翼耳骨、(鱗狀骨)
18	Supranasa	上鼻骨
19	Prenasal	前鼻骨
20	Palatine	口蓋骨
21	Pterygoid	翼狀骨、(前翼狀骨)
22	Mesopterygoid	中翼狀骨(翼狀骨)、(內翼狀骨)
23	Metapterygoid	後翼狀骨
24	Quadrate	方形骨、(方骨)
25	Symplectic	接續骨、(縫合骨)、(懸垂骨)
26	Hyomandibular	舌顎骨、(曲顎骨)
27	Opercle	鰓蓋骨
28	Preopercle	前鰓蓋骨
29	Subopercle	下鰓蓋骨
30	Interopercle	間鰓蓋骨
31	Premaxillary	前上顎骨、(前顎骨)
32	Maxillary	上顎骨
33	Dentary	歯骨
34	Articular	關節骨、(節骨)
35	Angular	角骨

Two New Blennioid Fishes from Japan

Kiyomatsu MATSUBARA and Akira OCHIAI

(Dept. Fisheries, Fac. Agriculture, Kyoto University)

While examining blennioid fishes from deep-waters around Japan and adjacent regions taken by motor trawlers, we found two interesting species not previously recorded from Japan. Upon careful examination of these specimens, they were found to represent new species, and described herein as *Lumpenus macrops* and *Lumpenella nigricans* respectively.

The counts and measurements were made in same manner as the senior writer has utilized in his previous studies on the Japanese deep-sea fishes. The expenses for the investigations of the deep-sea fishes were defrayed by the research fund of the Ministry of Education and Viscount Keizo SHIBUSAWA.

We wish to express our sincere thanks to Dr. Robert R. HARRY, Mr. Yoshimi HIRANO and Mr. Morizumi NAKAMURA for their assistance rendered in various ways.

Lumpenus macrops, new species
Medama-ginpo (New Japanese name)

Holotype.——No. 11201 (the numbers refer to MATSUBARA's Fish Collection, in which each specimen bears a separate number), male, 140.5 mm in standard length (157.5 mm in total length), off Kanaiwa, south western part of Noto Peninsula, Ishikawa Prefecture, muddy bottom, depth 200 meters, April 3, 1949.

Paratypes.——29 specimens, 11191–11200 and 11202–11220, 109.8–153.8 mm (125.0–173.0 mm), date the same as holotype.

DESCRIPTION.—— D. LVI; A. I, 35; P. 13; V. I,3. Branchiostegal rays 6. Scales 123 in a longitudinal series, 15 in predorsal, and 25 in a transverse series counted obliquely upward and forward from origin of anal to dorsal fin. Gill-rakers on first arch 5+14=19. Pyloric coeca. 4.

Head 4.88 in standard length; greatest depth 9.24; distance from origin of pelvic fin to anal fin 3.09. Greatest body width 2.74 in head; snout 4.97; maxillary 3.13; eye diameter 3.13; interorbital space 13.71; postorbital length of head 1.95; depth of caudal peduncle 4.97; pectoral fin 1.46; pelvic fin 7.20; pelvic fin spine 11.52; first dorsal spine 7.58; second dorsal spine 6.13; third dorsal spine 4.97; fourth dorsal spine 4.80; longest dorsal spine 4.06; anal spine 8.73; longest anal ray 3.20: caudal fin 1.58. Longest gill-raker on first arch 6.13 in eye diameter.

Body moderately high and compressed, a little higher than 1.4 times the width of body. Head compressed, its length slightly greater than one-fifth the body length, the upper profile roundly convex. Eye round, very large, its diameter equal to the upper jaw length and about 1.6 times as long as snout; interorbital space shallowly concave and slightly narrower than one-fourth the diameter of eye. Two nostrils on each side, the lower one with a moderately long tube; the rim of the upper nostril

slightly elevated. No tentacle on head. Mouth oblique; lower jaw included when mouth is closed; lips thickened; maxillary extending slightly beyond the anterior margin of pupil. Teeth small, villiform; those in upper jaw irregularly in 4 series anteriorly, in 3 series posteriorly, the outer ones much larger than the others; teeth in lower jaw in a single series except anteriorly where they are irregularly in 2 series; palatine with 2 small teeth; vomer toothless. Gill-openings continue forward to below posterior margin of pupil, the membranes narrowly joined to isthmus. Gill-rakers short, more or less triangular in shape, their tips pointed. Opercle large, the posterior margin extending slightly beyond the pectoral base.

Dorsal fin inserted slightly before the pectoral base, the spines slender, pungent and not flexible; the anterior spines never appreciably shorter, but the fin increases gradually in height toward the middle part of the fin; the longest spine is longer than length of snout; the membrane of the last spine joins base of upper caudal rays. Anal fin inserted under 21st dorsal spine, with 1 small pungent spine (1 or 2 in paratypes); the rays are all branched, increasing gradually in height posteriorly, the longest one longer than the longest dorsal spine, the last rays joining base of lower caudal rays by a low membrane. Caudal fin rounded, twice as long as the diameter of eye. Pectoral fin rounded, slightly longer than twice the diameter of eye, the middle rays the longest, scarcely reaching half way to uent; the lower 6 pectoral rays simple and thickened. Pelvic fin small, consisting of 1 spine and 3 simple rays, its length about 2.3 times in diameter of eye; pelvic fin spine inserted before a vertical from pectoral base by a distance equal to the length of snout.

Lateral line indistinct, running along middle of body from upper angle of gill-opening to base of middle caudal rays. Scales small, smooth and apparently imbricated; cheeks with a small but elongate patch of minute scales along their anterior margins, the scales can hardly be seen without an aid of lens; other parts of the head naked except for the nuchal region; fins naked except for the basal parts of both pectoral and caudal.

Color in formalin light yellowish brown, with a row of 11 large indefinite dark brown blotches on sides of body; the first blotch is immediately behind the head and the last on base of caudal fin; a small but similar blotch is present between each from fifth to tenth; a small indefinite blotch is present on preorbital region; tip of snout blackish. Caudal fin with 4 broad dark brown cross bars. Dorsal fin with 11 indefinite large elongate light brown blotches, the anteriormost much darker than the others; pectoral, ventral and anal pale.

The above description and illustration are prepared from the holotype. The counts and proportional measurements of the paratypes vary rather extensively except for the number of pectoral rays, pyloric coeca and vertebrae. See Table 1 which is based upon 17 males and 12 females. The number of anal spines is not constant in this species, since 14 types have a single spine and the others with 2 spines. The pelvic fins constantly have 1 spine and 3 soft rays

REMARKS.——The present new species rather closely resembles *Lumpenus medius*

(Reinhardt) at least in having the dorsal and anal fins joined to base of caudal fin, but these species can be separated by the following characteristics:

Table 1. Counts and proportional measurements in paratypes of *Lumpenus macrops*, new species.

Items	Males			Females		
	No.	Range	Average	No.	Range	Average
Dorsal spines	17	52—55	54.47	12	52—55	53.83
Anal spines	17	1—2	1.41	12	1—2	1.75
Anal soft rays	17	32—55	34.00	12	32—35	33.50
Pectoral rays	17	12—13	12.88	12	12—13	12.91
Scales in a long. series	17	114—123	119.00	12	112—121	116.58
Scales in a trans. series	17	22—27	24.41	12	22—26	24.58
Predorsal scales	17	12—15	13.05	12	11—15	13.16
Gill-rakers on upper limb	17	5—6	5.52	12	4—6	5.58
Gill-rakers on lower limb	17	14—16	15.00	12	14—17	15.17
Total gill-rakers	17	19—22	20.52	12	19—23	20.75
Pyloric coeca	13	4—6	4.23	9	4	4.00
Vertebrae	1	61	61.00	6	60—61	60.50
In standard length:						
Head length	17	4.56— 5.07	4.80	12	4.55— 4.95	4.74
Depth of body	17	8.26—10.39	9.44	12	8.13—10.22	9.25
Dist. from origin of pelvic to anal	17	2.57— 3.28	3.14	12	2.98— 3.28	3.09
In head length:						
width of body	17	2.57—3.84	3.15	12	2.53—3.33	2.84
Snout length	17	4.80—5.68	5.12	12	4.48—5.79	5.05
Maxillary length	17	2.86—3.32	3.05	12	2.91—3.39	3.14
Eye diameter	17	2.95—4.06	3.17	12	2.93—3.33	3.11
Interorbital space	17	13.85-17.78	15.94	12	14.10-17.06	15.70
Postorbital length of head	17	1.82—2.02	1.90	12	1.83—2.07	1.94
Depth of caudal peduncle	17	4.76—6.10	5.25	12	4.79—5.67	5.23
Pectoral fin length	17	1.41—1.66	1.55	12	1.36—1.55	1.45
Pelvic fin length	17	4.55—7.95	6.58	12	4.96—7.32	6.12
Pelvic spine	17	9.72-15.24	11.87	12	9.92-13.81	12.27
1st dorsal spine	17	5.76-11.39	7.88	12	6.32-11.08	8.22
2nd dorsal spine	17	4.97—7.02	5.89	12	4.90—6.90	5.91
3rd dorsal spine	17	4.18—5.70	4.81	12	4.47—5.82	5.07
4th dorsal spine	17	3.92—4.86	4.39	12	4.13—5.35	4.60
Longest dorsal spine	17	3.13—3.95	3.56	12	3.20—3.89	3.64
1st anal spine	15	6.95-10.39	9.07	11	6.93-11.73	9.07
2nd anal spine	17	5.88—8.82	7.45	9	5.71—8.42	7.11
Longest anal ray	17	2.93—3.35	3.12	12	3.08—3.48	3.25
Caudal fin length	17	1.47—1.68	1.58	12	1.49—1.74	1.62
In eye diameter:						
Longest gill-raker	17	4.94—6.67	5.58	12	4.94—7.54	5.85

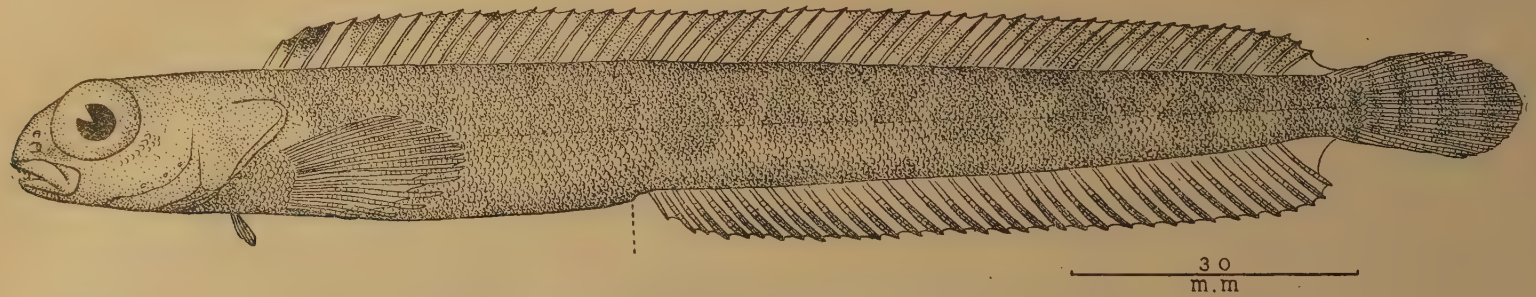


Fig. 1. *Lumpenus macrops*, new species. holotype. Drawing by K. MATSUBARA.

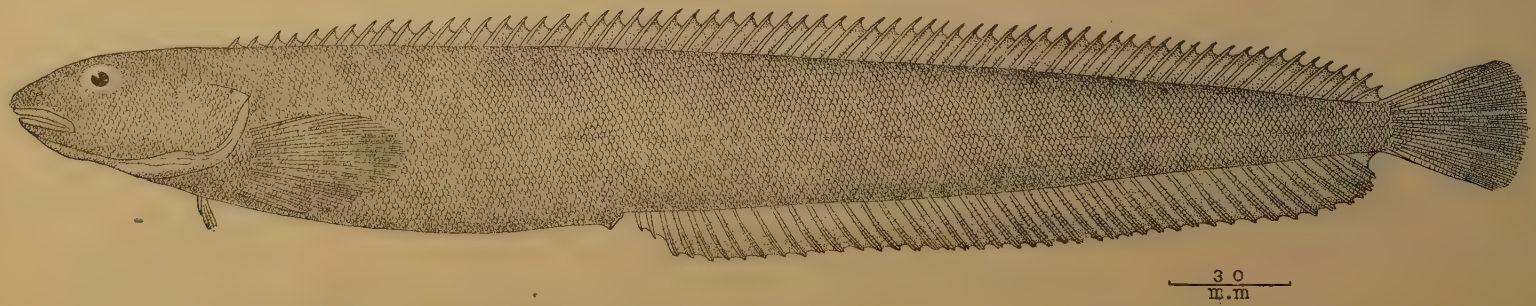


Fig. 2. *Lumpenella nigricans*, new species. holotype. Drawing by K. MATSUBARA.

Lumpenus medius	*L. macrops*
1. Dorsal spines 61 to 65.	1.……52 to 56.
2. Soft anal rays 39 to 43.	2.……32 to 35.
3. Pectoral rays 13 to 15.	3.……12 to 13.
4. Anal rays very low in front.	4.……not very low in front.
5. Head 6.0 into body length.	5.……4.55 to 5.07 in body length.
6. Ventrals longer, 3.33 into head.	6.……shorter 4.55 to 7.95 into head.
7. Gill-rakers 17 on first arch.	7.……19 to 23 on first arch.
8. Body uniformly pale olivaceus.	8.……with indefinite dark brown blotches on sides of body.

Concerning *Lumpenus medius*, TARANETZ (1937: 157) commented in Russian "in this species another form is found, which is not well known, but can be distinguished from it in having round eye, fewer dorsal spines and other characters." Agreement of our new species with this unnamed form is evident in characteristics of eye and dorsal fin, but they must be compared in other important features.

Lumpenella nigricans, new species
Nezumi-ginpo (New Japanese name)

Holotype.——No. 4946 (MATSUBARA's Fish Collection), female, 340.0 mm in standard length (374.0 mm in total length), off Kushiro, southern coast of Hokkaido, March 13, 1938.

Paratypes.——40 specimens, Nos. 7916-7932, 7634-7945, 7947-7956 and 10009, 236.0-338.0 mm (258.0-374.0 mm), date the same as holotype.

DESCRIPTION.——D. LXVI; A. II, 42; P 14; V. I, 3. Branchiostegal rays 6. Scales 190 in a longitudinal series, and 37 in a transverse series counted obliquely upward and forward from origin of anal to dorsal fin. Gill-rakers on first arch 4+16=20. Pyloric appendages 4.

Head 5.78 in standard length; greatest depth 7.31; distance from origin of pelvic fin to anal fin 3.21. Greatest body width 2.06 in head; snout 3.30; maxillary 3.72; eye diameter 5.03; interorbital space 4.98; postorbital length of head 1.94; depth of caudal peduncle 4.29; pectoral fin 1.47; pelvic fin 5.76; pelvic fin spine 10.31; first dorsal spine 14.70; second dorsal spine 14.00; third dorsal spine 10.50; fourth dorsal spine 10.69; longest dorsal spine 3.95; first anal spine 11.76; second anal spine 7.95; longest anal ray 3.30; caudal fin 1.72. Longest gill-raker on first arch 5.09 in eye diameter.

Body stout, compressed and moderately high, a little higher than 1.6 times the width of body. Head compressed and moderately large, the upper profile slightly convex above eye. Snout long, about 1.5 times as long as eye diameter. Eye elongate, moderately large, but much shorter than upper jaw length. Interorbital space slightly convex and about as wide as eye diameter. Two nostrils on each side, closed together, the anterior one very small, with a short tube and scarcely visible without an aid of lens; the posterior one much larger than anterior one, bearing a moderately long and broad nasal tube. No tentacle on head. Mouth rather small, horizontal; lower jaw included under the closed mouth; lips rather thickened; upper jaw length about equal

to half the length of snout plus eye, its posterior extremity ends slightly before the anterior margin of eye. Teeth small, villiform and in jaws only; no teeth especially enlarged; those in the upper jaw irregularly in 2 series; the teeth in lower jaw in 2 series anteriorly and in a single series posteriorly. Gill-openings continue forward to below middle of eye, the membranes narrowly joined to isthmus. Gill-rakers short, compressed and pointed. Opercle extending posteriorly a vertical through pectoral base.

Dorsal fin inserted above midway between tip of opercle and upper anterior end of gill-opening; the spines short, stout and pungent, its anterior 5 or 6 rays very short, then the fin increases gradually in height posteriorly to opposite middle of anal fin base, then decreases gradually to the posterior end, the longest spine is longer than eye diameter, but shorter than snout length; the tips of the spines always naked; the membrane of the last spine joins base of upper caudal rays. Anal fin inserted under the base of 23rd dorsal spine, with 2 pungent spines (in paratypes 31 with 2 spines and the others with 3 spines, but no specimens were found to exist with 4 or more anal spines); the rays are all branched, increasing gradually in height posteriorly, the longest ray much longer than the longest dorsal spine; the membrane behind the last anal ray never reaches to base of lower caudal rays. Caudal fin nearly truncated, longer than half the length of head and about 3 times as long as the diameter of eye. Pectoral fin rounded, longer than 3 times the diameter of eye, the middle rays the longest, scarcely reaching half way to vent, the lower 2 rays (2 or 3 rays in paratypes) simple and more or less thickened. Pelvic fin small, consisting of I small pungent spine and 3 longer soft rays, its middle ray is branched; pelvic fin inserted before a vertical from lower pectoral base by a distance equal to the eye diameter.

Lateral line distinct, running along middle of body from upper angle of gill-opening to base of middle caudal rays. Scales small, smooth and imbricated; head wholly covered with small scales except for lips and branchiostegal membrane; dorsal fin membrane scaly except for the distal area; basal part of caudal and pectoral fin also scaly; other fins naked.

Color in formalin dark brown throughout body and fins, but the belly, lips, branchiostegal membrane and the fins except for dorsal darker.

The above description and illustration are prepared from the holotype. As given in Table 2 rather remarkable variations are found to exist in paratypes in counts and proportional measurements except for the number of dorsal fin spines, anal and pectoral fin rays and that of vertebrae.

Remarks.——The present new species closely resembles *Lumpenella longirostris* (Evermann et Goldsborough) known from Alaska to Nanaimo [Evermann and Goldsborough, 1906 (1907): 340, fig. 115; Hubbs, 1926 (1927): 378; Soldatov and Lindberg, 1930: 474; Taranetz, 1933: 75; Schultz, 1936: 193; Taranetz, 1937: 157], but these species can be distinguished by the following characteristics:

Table 2. Counts and proportional measurements in paratypes of *Lumpenella nigricans*, new species.

Items	Males			Females		
	No.	Range	Average	No.	Range	Average
Dorsal spines	4	64—67	66.25	36	65—68	66.50
Anal spines	4	2—3	2.50	36	2—3	2.19
Anal soft rays	4	40—43	41.50	36	41—44	42.08
Pectoral rays	4	13—14	13.50	36	13—14	13.08
Scales in a long. series	4	182—192	187.25	36	180—210	194.47
Scales in a trans. series	4	33—40	36.25	36	33—42	37.41
Gill-rakers on upper limb	4	3—4	3.75	36	3—5	3.47
Gill-rakers on lower limb	4	13—16	14.75	36	13—18	15.30
Total gill-rakers	4	17—20	18.50	36	17—23	18.77
Pyloric coeca	4	5	5.00	36	3—6	4.94
Vertebrae	—	—	—	15	73—75	73.46
In standard length:						
Head length	4	5.74—5.97	5.87	36	5.51—6.48	6.00
Depth of body	4	7.42—8.68	8.12	36	7.22—9.34	8.58
Dist. from origin of pelvic to anal	4	3.27—3.42	3.36	36	3.15—3.49	3.34
In head length:						
Width of body	4	2.06—2.60	2.27	36	1.91···2.60	2.27
Snout length	4	3.06—3.41	3.17	36	2.90···3.41	2.97
Maxillary length	4	3.52—4.27	3.87	36	3.37···4.45	4.15
Eye diameter	4	4.90—5.20	5.05	36	4.68···5.42	5.17
Interorbital space	4	5.43—5.79	5.61	36	4.68···6.34	5.54
Postorbital length of head	4	1.89—2.07	1.98	36	1.85···2.08	1.99
Depth of caudal peduncle	4	4.17—4.69	4.38	36	3.11···5.22	4.42
Pectoral fin length	4	1.44—1.46	1.45	36	1.23···1.63	1.41
pelvic fin length	4	5.00—5.96	5.48	36	4.45···6.65	5.94
Pelvic spine	4	8.33—9.96	9.33	36	8.48-13.21	10.35
1st dorsal spine	4	11.97-15.83	14.25	36	11.63-18.87	14.34
2nd dorsal spine	4	10.26-12.57	11.82	36	9.27-15.13	11.77
3rd dorsal spine	4	8.33-11.31	10.21	34	7.43-12.09	9.64
4th dorsal spine	4	8.00···9.50	8.77	34	6.50-10.58	8.92
Longest dorsal spine	4	3.30···4.03	3.73	36	3.19···4.65	3.82
1st anal spine	4	10.00-11.88	11.21	36	7.90-14.36	10.72
2nd anal spine	4	6.45···9.19	7.53	36	5.78···9.65	7.07
Longest anal ray	4	2.86···3.92	3.30	36	2.90···3.60	3.26
Caudal fin length	4	1.63···1.68	1.65	36	1.27···1.83	1.66
In eye diameter:						
Longest gill-raker	4	4.41···6.57	6.15	36	3.72···7.47	5.13

Lumpenella longirostris	*L. nigricans*
1. Anal spines 3 to 5, but mostly 4.	1.·····2 or 3, but 2 in most examples.
2. Caudal rounded.	2.·····nearly truncated.
3. Dorsal fin gradually increases in height to opposite front of anal fin.	3.·····gradually increases in height to opposite middle of anal fin base.
4. Dorsal fin begins immediately above upper end of gill-opening.	4.·····begins above midway between tip of opercle and upper end of gill-opening.
5. Head long, 5.25 in body length.	5.·····shorter, 5.50 to 6.50 in body length.
6. Back and upper side light olivaceus with dark brown blotches.	6. Body dark brown throughout

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稀魚の生活色に就いて（第2）

黒田長禮

On the life colors of some rare Fishes.—II

Nagamichi Kuroda

(19). **サザナミフク** 一名ヨコシマフグ *Tetraodon hispidus* Linne 1946年10月19日志下沿岸近くにて採集幼魚全長 60.5mm 及び 1947年10月23日 桃郷にて採集全長 44.5mm. 是等の標品は大体に於て Günther (Cat. Fish. Brit Mus.) の記載に一致する。背面は暗オリーブ褐色、眼先き、眼下部及び体後方は色淡く、帯オリーブ淡褐色で、眼先きと吻中央に各1微小蒼白点があり、その他の背面、体側、尾柄、C. 基底に蒼白色の長味小点又は後方程微小点を有し、喉部や体後方の下部にあるものは圓点となる。又圍眼部は黒色で、その後半輪縁は細き蒼白色。P. 基底と鰓孔（その縁は黄線）とを含める部は黒色で、而して黄色の1圓縁にて兩部を一所に緣取る。下顎基部は黒い。D. P., 及び A. は何づれも白色で、僅に黄味を帯び、C. は基部$^2/_3$はオリーブ色、先ㇲは黒色となる。腹部は擬白色の地に14の縦帯があり、黒色で、前方は淡汚褐色の細線となり、第5縦帯は左右共後方に屈出部があり、次のものは後方中斷する。尙ほ肛門前には短き稍々半輪形の2黒横斑をなしている。

因に *T. sazanami* Tanaka をホシフグのシノニムとする人もあつたが、私は阿部宗明博士の分類に從つて *T. hispidus* のシノニムと認める。私の採集したホシフグの稚魚はホシフグの成魚同様に腹に暗色帯はなかつた。この点から見ても *T. sazanami* はホシフグの仔ではない様に思われる。

(20). **ウケグチメバル** *Sebastodes scythropus* Jordan *et* Snyder. 1951年7月31日伊豆松崎附近 120～130 尋で福本正之君釣獲のもの全長 225mm. を入手した。体の地色は美しい淡紅赤色で、腹方は銀白色に富む。頭側も淡赤白色、側線は淡紅紫色を呈する。頭上から背方は黄金オリーブ色で、体側に此色からなる 4 横帯があるが、これは雲形斑と云う方が當る。Jordan & Snyder (1900) の原圖に一致する。この横帯の下方は濃赤色となる。鰓蓋上の黒横帯は明瞭で、これも帯黄金暗褐色を呈する。D. 棘は帯紅色、膜は黄オリーブ色である。第2背鰭は P., V., A. 及び C. と共にバラ赤色で美しい。C. は中央に幾分黄オリーブ色の1淡横斑が不鮮明に存する。鰓條皮は暗桃紫色を呈するが、鰓の色よりは淡い。眼瞼部は帯赤色、虹彩は黄金色。上下唇は淡赤色である。

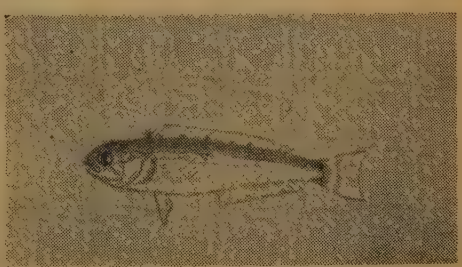
(21). **シロカサゴ** *Setarches fidjiensis* Günther 1947年12月27日 伊豆戸田沖トロールの成魚全長 203mm. を入手。虹彩は橙黄色に微小暗点がある。体色は シロカサゴ の名はあるが生時は全身鮮濃赤色（或は帯紫赤色）で、アヤメカサゴと共にあるときは後者の方は白赤色に見える程である。頭部、背方及び体後半は殊に濃赤色が強い。上顎上緣の凹部は灰黒色。体には極めて不判明の淡灰色の横帯4個があり、体下方に至つて消える。頭の大部分と体には微小暗点があり、体鱗は細かい圓形である。腹正中線には P. 基部と肛門間に長 45mm. 幅 4·5mm. の灰黒色の1縦帯があり、これは丁度兩者間一パイに達する。側線は明瞭で暗赤色，鰓蓋前骨棘第2は多少短い感ある程度でアカカサゴ (*S. longimanus* (Alcock *et* Mcgrichrist) の如く微小にあらざること及び D. の最後から第2番目（11番）の棘長は頭長の $^1/_{10}$ よりも多くは長いこと（アカカサゴでは $^1/_{10}$ より短い）は共に特徴である。D. 棘軸は赤色、その膜は淡紅色で、棘は膜外に半位出る。その膜の上緣は第1棘を除き他は灰黒色で後方に至れば膜の大部分にも此色を帯びる。軟條部は軸淡紅色、膜は開けば殆ど無色透明。P., V. 及び A. は鮮赤色濃く、A. の方幾分淡く、而して各鰭は開けば膜は殆ど無色透明、V. 基部の軸は2～3白い。A. の軟條部基部には多少暗色斑がある。C. は

美しいバラ赤色で、開けば膜は殆ど無色透明である。眼の形は擬三角形で、瞳孔は楕圓形である。

(22) **ヒメヤマノカミ** *Brachirus bellus* JORDAN et HUBBS. 1947年12月9日千本沖手繰網に入つた幼魚（全長62mm.）を入手した。セトミノカサゴに似るが体が卵形で長味が少く体高が高い。一見した体色は岡田・内田・松原、1935, pl. 120, fig. 3に一致する。しかし幼魚の爲め多少の差がある。体の地色は灰赤色で、頭を除き不判明の5横帶があり、是等の帶は成魚では暗赤色なるが、本品では暗赤褐色で殆ど赤味はない。頭側は淡紅色の地に眼後方に暗赤褐色の不判明縦斑3個がある。眼下には不規則に5赤色斑がある。体側から腹方は銀白色を帶びる。觸手狀突起（皮質）は眼上1個（黒色）、眼下骨に1個（帶白赤色）あるのみ〔成魚の様に鼻孔壁に1個、眼下骨に2個はない〕。D. 棘は桃色を主とし、それに赤色と黒色との小斑があり、多少交互するが、成魚の様に此暗斑が3～4列をなさず1～2列にすぎない。D. 軟條はC. と同様灰黄色の地に幾分桃色を帶び、黒色の小点を散在する。P. は長く桃色の地に5擬黒色横帶があり〔成魚の様に赤色横帶でなく、又P. 先端が幅廣の黒色でもない〕。V. は淡白桃色地に4擬黒横帶が明瞭にあり〔成魚の如く赤横帶でない〕。又A. はV. と同色で、それに4擬黒横帶があり、中央2個は明瞭、他は桃色を加味し不判明〔成魚の如く赤横帶でない〕。虹彩は灰赤褐色、内細輪は黄金色である。

(23) **ヒメオコゼ** *Minous monodactylus* (BLOCH et SCHNEIDER). 1946年11月10日桃郷沿岸小地曳網で漁獲の1点（全長 87mm.）入手。虹彩は淡黄白色、上方暗褐色、下方に暗褐色の放射小斑がある。体の背方は灰色地に多くの淡灰黒色の不判明な横斑があり、D. 軟條部下では横の虫喰斑となる。側線は背方近くにあり、尾柄上縁近くに達する。側線下には稍々太い不規則の縦斑があり、2縦帶を形成する。腹方は白地に多少桃色を帶びる。P. により蔽われる部分は無斑の帶淡桃白色である。腹側後方のA. 基部上方は灰黒色に淡桃色を帶びる。頭部には多くの粒狀点や棘を有し口角上方と鰓蓋前骨に生じる2棘は白色で稍々長く鋭い。眼の前後に小棘があり、眼後部と眼後上方とに各2個の粒棘狀突起があり桃色を帶びる。又眼下より鰓蓋の鋭棘迄の間に粒狀隆起があり、これと此棘の上下方も桃色を帶びる。頭の地色は灰黒色である。下顎には各側2對の白色の小觸鬚がある（短い）。D. の膜は淡灰色で上端に細黒縁があり、棘膜に灰色斜線があり、軟條部前方に1大黒斑があり、それが各3條の斜横斑に分れる。P. の最下方の1軟條は遊離し、全体黒色で、6～7横線が不判明に存在する。P. 裏面は美しき暗赤色で、縁が黒く、上面より一層不判明な暗色横線がある。遊離軟條は黒く先き 1/3 位は gamboge yellow となる。V. は黒色で、基部 1/3 位は灰白色、前方の基部に紅色の1小斑点がある。A. は黒色。C. は多少黄味ある白地に3灰黒色横帶がある。これらの黒帶は個体變化に富む。

(24) **クジメ** *Agrammus agrammus* (T. et S.) 1947年2月22日志下沿岸近きシラス手繰網に入つたクジメ幼形（阿部宗明博士同定）1点を入手した。全長45mm, 体高8 mm.の小魚で多少シイラに似た形で、成魚とは全然異つた体形と体色とを有する。体の背方から前頭は誠に冴た鮮蒼綠色で、その下縁は多少灰色の1線となる。側線上方の小區域と側線下は一様なる帶蒼銀色。P. 基部、尾柄後端とC. 部は蒼綠色。頭上は暗桃色〔内部が透視〕、鰓蓋は銀色で、多少帶蒼色。D. は1基で基底長く、無色透明で、基部に5～6の小灰色点が不判明に列在する。P. とV. とは無色透明、C. も大部分無色透明で基部に多少近き部に1淡灰色横線が不判明に存し、C. の後縁は凹入型で極めて淺い。虹彩は銀色で、上下に各々1鮮赤色斑がある。



第3圖　クジメ幼形全長
45粍のもの　背方は鮮蒼綠色
著者寫生　志下シラス網にて

此幼型は頗る珍らしく、私には同定が出來兼ねたので阿部博士の手を煩わしたことを玆に深謝する。阿部氏、日水産學會誌、xvi, no. 11, p. 497, 1951 及び小川良徳氏「採と飼」vol. 13, no 8, pp.238～240 は參考となる文献である。

(25). **ウロコカジカ** *Stlengis misakia* (JORDAN et STARKS) .1948年1月22日伊豆大瀬沖トロール、150～250尋で漁獲の2点を入手、全長86, 88mm. 虹彩はオリーブ褐色、内細輪は黄金色。背面は帶オリーブ黄色のものと帶紅褐色のとがあり個体變化の1例を示す。眼前から頭上は暗バラ色を帶びる。眼下に灰褐色の斑紋があり、中1個は眼下に向う。鰓蓋前骨にある鈎は長く、4棘鈎を有し、下方には3棘がある。鰓條の後方のものに2黒斑がある。側線下に1縦列鱗があるのみ〔特徴〕。其の下緣に接し暗褐黒色の圓点又は擬圓斑8～9個以上ある。これは個体により數と形に相違がある。D. は淡灰色地に2灰色縦帶と第5～第9棘の上方に特徴たる1.大黒斑がある。軟條部は淡灰色の地に4灰色斜帶がある。P.は淡黄色に灰色微小点があり、基部上方に1黒擬圓点が明存する。V.とA.は白色。C. は淡シトロン黄色で、先方近くに不判明の暗色斑点があり、基底上方に1黒擬圓点が明存する。

(26). **キヌカジカ** *Furcina ishikawae osimae* JORDAN et STARKS. 田中博士 (1931) や清原教授 (1950) はサラサカジカ (*F. ishikawae*) とキヌカジカ (*F. osimae*) とを合一した。しかし斑紋上の相違とID. に明かな缺刻のあること等で後者は前者の亞種又は型として分つべきかと考える。1946年5月31日我入道の小タイドプールで幼魚10点 (全長42.5～65mm.) を採集した。是等は全部 ID. に缺刻が明存し、斑紋は JORDAN & STARS, Proc. U. S. Nat. Mus., xxvii, p. 305, fig. 33 に全く一致し同書の fig. 32 (サラサカジカ) とは全く異る。虹彩は橙黄赭色、内細輪鮮赤色である。頭部はオリーブ灰色、下顎から鰓條は蒼綠色。ID. は白地に紫灰色の不規則の斑帶があり、IID. は淡黄色の地色に8～9の赤藤色の斜帶があつて頗る美麗である。体側は前半黄綠色、後半赭紅色で背方に4～5個の灰褐色緣ある淡色斑があり、体下半部に凹凸した波状の灰褐色1帶があり、其凹部は多くの黄色小斑を包む形をとる。P. は赭紅色、A.は綠黄色に淡褐軸斑があり、C. は淡赭紅色に黄色の小横斑を所々に散在する。

牛臥～我入道間の砂濱間の岩礁地帶には紅・褐・綠の3種藻類が繁茂しその爲め本種やコケギンポ等の体色に大に變化に富むのは誠に面白い現象である。

(27) **イダテンカジカ** *Ocynectes maschalis* JORDAN et STARKS. 1948年6月7日我入道にて1点 (全長47mm.) を採集。背及び側線上方は葡萄灰色の地に擬黒色の約5横帶がある。眼下部に4点程の擬黒色斑があり兩顎にも鰓條にも小擬黒斑がある。上下唇には黒点の外、綠蒼色と白色との小斑点がある。側線下に上向した半月形黒斑が6～7個連續し、各々の中心は灰桃色の1点を有する。口角、鰓蓋の鰓條、胸から腹は淡美綠蒼色である。ID. は第4棘部が多少凹み、膜は無色透明で、後端に1擬黒色点があり、前端と中央にも少量の灰黒点と1縦帶とが不判明に存する。IID. は透明膜を有し、各軟條に淡灰色と灰紅色との交互点がある。P. は透明で、各軟條に橙黄色と灰黄色との交互点を有し、基部に灰黒の1大斑がある。V. は淡綠白色。A. は透明、僅かに淡灰色と灰紅色との小点が交互する。C. は淡黄白色で透明、それに灰紅色の3横点列が明存する。虹彩は淡紅灰色。當灣では非常に稀種である。

(28) **アサヒアナハゼ** *Pseudoblennius Cottoides cottoides* (RICHARDSON) .アナハゼ (*P. c. percoides* GÜNTHER) とは同1種で只亞種的の差であると考えるのが正しい様である。我入道にて 1948 年6月7日に沿岸海藻中から採集した。これは岡田・内田・松原、日本魚類圖說、1935, pl. 125, fig 3 に全く一致した色彩である。しかし生活中は色彩が著しく淡色である。詳細は略す。虹彩は上方灰色、下方銀白色で、眼先きから眼を斜走する暗紅色帶がある。死後は前記圖說の圖通り暗赤色の虹彩と變る。

アナハゼの体色は普通型は蒼味少き黄オリーブ色を主とするが、綠藻類の多い桃郷沿岸のものは蒼色を著しく帯びて來る。体色や斑紋ではアサヒアナハゼとは一見して大に異るものである。

（29）**オビアナハゼ** *Pseudoblennius cottoides zonostigma* JORDAN et STARKS. これもアサヒアナハゼの1亞種と見るのが正しい様である。1947年9月19日伊豆田子附近のアジ夜網に入つた只1点（全長104.5mm.）を入手した。他の亞種よりも多少深海性らしい。虹彩は紅銀色、上方綠オリーブ色、下方に1褐色斑があり、內細輪は紅黄色、其他瞳孔と上方との間に帶赤色2～3の点と線とがある。時を經れば虹彩は一様の暗褐色に變じた。体形はアナハゼに類似し、体面にも粘液が多い。背面は淡焦茶色で側線は美しい赤紫色でその下方は帶淡紅白色で、約6横帶があり、各帶は不規則ながら2平行狀をなし各帶は何づれも暗黑褐色の擬圓点から成る。ID. の棘軸は暗董色、膜は淡オリーブ灰色、第1棘膜上端と第8～10棘の膜に各1黑大斑がある。〔特徵〕。是等の膜及軸に美紅色の長味斑がある。IID. は ID. より明に高く、膜は淡バラ白色（透明）、軟條軸は淡暗董色で、それに美紅色の約5～6横点列をなしている。P. は上方 $^{2}/_{3}$ は淡紅白色に紅軸を、下方 $^{1}/_{3}$ は黄色軸を有する。V. は不透明白色。A. は IID. と同様で約4～5横斑があり基部の2帶は紅茶色である。C. は分岐軟條の先端 $^{1}/_{3}$ は淡橙黄色、基部 $^{2}/_{3}$ の軟條軸は赤色である。

（30）**キホウボウ** *Peristedion orientale* T. et S. 1948年1月22日伊豆大瀬沖トロール、150～250尋で漁獲の2点（全長鼻突起共 104, 205mm.）を入手した。上記の內小形の個体は体色が帶赤黄色でキホウボウの名に當るが、大形の方は帶黄紅色で、赤味が著しく強い。故に一般に考えられるよりも赤きものらしい。ID. の上緣は黑く、IID. は上緣幾分黑点を有するも黑緣とはならない。此軟條部中に1淡褐点列あるのが普通である。体の虫喰形の斑線はヒゲキホウボウより暗色で暗褐色を呈する。P にも2帶があり淡赤色で是等の帶中に少し暗褐斑を交へる。虹彩は淡黄金色、上方灰色、內細輪は黄金色である。

（31）**ヒゲキホウボウ** *Satyrichthys amiscus* (JORDAN et STARKS)、前種と同日伊豆大瀬沖トロールで漁獲の2点（全長鼻突起共182, 208mm）を入手。体は紅色で、幾分黄色と赤色とを加味するが頗る濃紅色に見える。以上は成魚と中成魚のことで若し幼魚なれば黄味が多くなるかとも思う。鼻突起は幅廣く上から見て淡紅白色である。頭甲部は一体に濃暗紅色、後方の突針は淡色となる。背は帶赤紅色、体の網目斑は、濃暗紅色。鬚は濃鮮紅色。D. 棘は淡灰色、先半眞黑色、軟條は淡バラ色で、その前部の上緣は少しく灰黑色。P. は濃灰黑色、基部と先端は少しく白色にバラ色を帶びる。P. の遊離軟條はバラ白色。体棘は灰白色。A. は帶白色にバラ色を帶び，C. もバラ白色である。虹彩は銀色で、外輪は深バラ赤色を呈す。〔本種の屬名については蒲原氏近著參照〕。

（32）**ワニギス** *Champsodon vorax* GÜNTHER. 1945年11月2日千本沖手繰にて漁獲の1標品（全長84.5mm.）背面は淡帶黄淡綠色に僅に淡桃色を帶び、背と側面とに淡褐色の多數の小汚斑点を散在するので、一見背面が褐色に見える。側面と肛門以下の尾部の地色は淡黄金色。腹部、鰓蓋及び胸側は光銀色に僅に黄味を帶びる。下顎と上唇は桃色を帶びる。各鰭は殆ど無色で、D. は多少褐黄色を帶びる。C. は明かに美黄色である。C. 基底には1大灰黑斑がある。虹彩は黄褐色、下方に1赤点がある。本種のこの色の記載は始めてかと思う。

（33）**コケギンポ** *Zacalles bryope* JORDAN et SNYDER. 1946年5月31日牛臥岩礁で1尾（全長57mm）及び我入道岩礁で1尾（全長34mm）を得た。前者は紅藻ある處から採集のもので体色、斑紋の外は葡萄赤色を呈し、P. の基部に帶黄銀白色（暗斑入）の1大斑がある。虹彩は赤色で黑色放射斑がある。我入道の標品は普通色で褐藻地域で採集のものである。即ち体色は飴色で、体側上半は暗黑褐色、下半は淡黄飴色をなし、横斑は極めて細い。上下の境は極めて鮮明。P. 基部に黄銀白色（無紋）の大斑がある。虹彩は暗褐色。

以上で見る如く体色の棲息地による相違は虹彩の色迄体色に一致して變化することが知られる。

(24) **アイトラギス** *Bembrops caudimacula* STEINDACHNER. 1946年1月18日千本沖70—80尋の手繰網に入つた幼魚2点（全長70, 174mm）を入手した。これは來從ハイゴチ（*Bembradon laevis* NYSTRÖM）と稱したが、蒲原教授（1950）や私の調査ではアイトラギスの幼魚なることに落着し得た。虹彩は上方蒼色、下方は帶黄白色に橙赤色斑があり、内細輪は黄金色。背面は半透的淡灰色で、鱗は大形で各緣は暗灰色で菱形網目狀に排列し、体側に光ある綠黄色の斑が縱帶狀に2～3列あるも極めて不規則にある。此金綠黄色は吻及び頭側にもあること光線によつて見られる。腹面は擬白色、D. は淡色で、それに淡綠黄色の小斑があり、ID. の第1～2棘間に眞黑色斑が1個ある。P. は殆ど白色、軟條は暗色線となり稍々明瞭。V. は白色で暗色軟條は不判明。A. も同様で暗色線は黑く尙ほ明瞭となり基底に暗色の小縱短線が平行に梯狀に列ぶ。C. は淡色地に暗色細縱線が軟條にあり、その他綠黑色5～6個の長圓斑があり、上方基底近くにある1長圓斑は最も明瞭で、今回の大形標品ではその内に金綠色の小斑を有する。C. 上方軟條は少しく延び淡綠黄色を呈する。後頭から頭側は桃色を呈し、鰓蓋には金綠黄色の數個の小圓斑と同色の虫喰形の數個の小斑とがある。

以上の色彩の記載は今回始めて公になると思う。因に成魚との相違其他の点は拙稿「魚類學雜誌」第1卷第1號及び「動雜」61卷6號175頁參照のこと。

(35) **イイジマダルマガレイ** *Psettina iijimae* (JORDAN et STARKS), 1948年2月4日志下にて幼魚1点（全長51mm.——成魚でも120mm. 位迄）。有眼側は一樣な暗灰色で、D. と A. に沿える体の上下方に4對の小圓斑が粗在し、側線上下の体の中央部には認められない。側線上には4～5の暗灰黑色斑点と体後方の側線下に擬圓斑線があるが、稍々不明瞭。鰓蓋部は暗桃色。D.,A. 及び V. は膜が淡色で、軟條に暗褐色小軸斑2～3を有する。C. も同樣の地に先端近くに暗褐色の1横帶があり、其他不判明の淡褐色横斑又は横帶を有する。虹彩は上方灰褐色、下方は淡色、内細輪は黄金色。無眼側は白色。D. 90; A. 69; Scales 59.

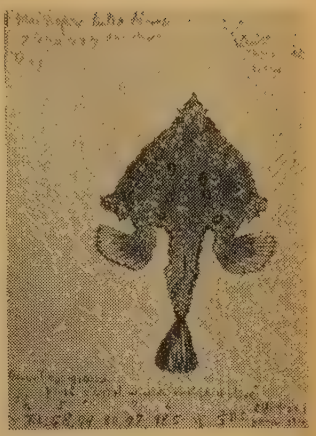
(36) **エゾイソアイナメ** *Lotella maximowiczi* HERZENSTEIN. 1946年10月31日千本沖手繰網に入つた中幼魚1点（全長173mm,. ID. 10; IID. 65+; A. 70）を入手した。虹彩は濃暗褐色、内細輪は白色、背面は暗オリーブ色に黄色を帶び、体側は幾分淡く、鰓蓋後方と、P. 附近の上下部、喉及び腹は暗黑藍色（方言ノドクロ）。A. の始部上方に接する部に多少銀白の細き1縱帶がある。ID. は基部オリーブ色、次に淡紅色、先端に黑色の3帶を有する。IID. はオリーブ黄色で、所々に不判明の淡灰色の大斑狀があり、上緣黑細緣となる。P. は美淡紅色，V. も淡紅色。上下唇は淡桃色，顎及び觸鬚は基部淡紅色、先白である。A. は前方基部淡蒼色、大部分は淡灰色、次に美桃色部が長く、最後は淡黄色で、外緣は細黑緣となる，C. は灰オリーブ色で、中部以下の下方は淡黄色である。因にイソアイナメ一名ヒゲダラ（*L. phycis* (T. et S.)）とは鰭の軟條數の相違の外、体色も著しく異るらしい。田中博士の原色日本魚類圖鑑のヒゲダラと比せば全く異る。エゾイソアイナメの稚魚（全長50mm. 内外）を檢したが上記の中幼魚と色彩上の差は認められなかつた。

(37) **ワヌケフウリュウウオ** *Malthopsis annulifer* TANAKA. 1948年1月22日伊豆大瀬沖トロール、150～250尋で漁獲の5点（全長58～98.5mm）を入手した。背面は帶灰紅色に微かに橙色黄とオリーブ色とを帶びる。眼下部と尾部兩側とは帶赤色。大体に於て大形のものは赤味多く、幼は灰色に富む樣なれども、個体的に暗色のものと淡色（赤味多き）のとある。体背面と尾背には白色の星形斑が多い。D. 5（蒲原氏の調査通りで、6～7は別種）で、淡汚黄色。P. は淡黄白色、基半は淡黄赤色、V. は擬白色、基部に少し橙黄赤色を帶びる。C. 下方 1/3 軟條は鮮バラ赤色、上方 2/3 は淡帶黄白色。これも個体的に赤色の少きものや殆どないものもあるが、P. と C.

に明瞭な1横帯は認められない。〔これは幼の爲めか又は種の異る爲めか〕。虹彩は黄金色、上方は灰褐色である。

体の背面には黒縁の圓斑又は長味斑が種々に變化し、浦原氏（1950）の調査では 1～16 個となつているが、私の例では 0～7 個でこれは見た數の少い爲めと思う。表記すると次の通り。

全　長	背の圓斑數	背面の地色
58mm	5	帶灰色
79	なし	同上、少し赤味
80	なし	同上、同上
97	7	灰紅色
98.5	6	灰紅色



第4圖ワヌケフウリユウウオ全長 98.5 粍のもの　背面の円斑6個
著者寫生　大瀬沖トロールにて

Résumé

The part two of this article contains descriptions of life colors of the specics nos.19–37. The life colors of the following fishes have not hitherto been described or described only briefly by previous authors: *Sebastodes scythropus; Setarches fidjiensis; Brachirus bellus;* very young stage (total length 45 mm.) of *Agrammus agrammus* with vivid bluegreen back;*Stlengis misakia; Furcina ishikawae osimae; Ocynectes maschalis;* three forms of *Pseudoblennius cottoides; Peristedion orientale; Satyrichthys amiscus; Champsodon vorax;* two color types of *Zacalles bryope; "Bewbradon laevis"* (this fish is now considered as a young stage of *Bembrops caudimacula,* which coincides with the opinion of Prof. KAMOHARA (1950); stage *Psettina ijimae; Lotella maximowizi; Malthopsis annulifera;* etc.

新 潟 縣 魚 類 目 錄（続き）

本 間 義 治
（新潟大學理學部生物學教室）

A List of the fishes collected in the Province of Echigo, including Sado Island. *Continued from p. 145*

Yoshiharu HONMA
(Biol. Dept., Fac. Sci., Niigata Univ., Niigata)

Family Sciaenidae ニ ベ 科

171. *Nibea mitsukurii* (JORDAN et SNYDER) ニベ +S
172. *Nibea argentata* (HOUTTUYN) イシモチ +S

Family Pseudochromidae メ ギ ス 科

173. *Dampieria cyclophthala* (MÜLLER et TROSCHEL) メギス S ?
能生水産學校 (1933)

Family Oplegnathidae イ シ ダ イ 科

174. *Oplegnathus fasciatus* (TEMMINCK et SCHLEGEL) イシダイ T
175. *Oplegnathus punctatus* (TEMMINCK et SCHLEGEL) イシガキダイ S

Family Mullidae ヒ メ ジ 科

176. *Upeneus bensasi* (TEMMINCK et SCHLEGEL) ヒメジ +S

Family Aplodactylidae タカノハダイ科

177. *Goniistius zonatus* (CUVIER et VALENCIENNES) タカノハダイ S
178. *Goniistius quadricornis* GÜNTHER ユウダチタカノハ S
179. *Goniistius zebra* (DÖDERLEIN) ミギマキ S

Family Sillaginidae キ ス 科

180. *Sillago sihama* FORSKÅL キス S

Family Branchiostegidae ア マ ダ イ 科

181. *Branchiostegus japonicus* (HOUTTUYN) アマダイ +S

Family Cepolidae ア カ タ チ 科

182. *Cepola schlegeli* (BLEEKER) スミツギアカタチ +S
183. *Acanthocepola krusensterni* (TEMMINCK et SCHLEGEL) アカタチ +S

Family Embiotocidae ウ ミ タ ナ ゴ 科

184. *Ditrema temmincki* BLEEKER ウミタナゴ T
185. *Neoditrema ransonneti* STEINDACHNER オキタナゴ S

Family Pomacentridae ス ズ メ ダ イ 科

186. *Pomacentrus coelestis* JORDAN et STARKS ソラスズメダイ S
187. *Chromis notatus* (TEMMINCK et SCHLEGEL) スズメダイ S

Family Labridae ベ ラ 科

188. *Choerodon azurio* (JORDAN et SNYDER) イラ S
189. *Semicossyphus reticulatus* (CUVIER et VALENCIENNES) コブダイ S

190. *Pseudolabras japonicus* (Houttuyn) ササノハベラ　S
191. *Halichoeres poecilopterus* (Temminck et Schlegel) キウセン　+S
192. *Halichoeres tenuispinnis* (Günther) ホンベラ　S
193. *Thalassoma cupido* (Temminck et Schlegel) ニシキベラ　S
194. *Iniistius dea* (Temminck et Schlegel) テンス　S

Family Zeidae　マトウダイ科

195. *Zeus japonicus* (Cuvier et Valenciennes) マトウダイ　+S

Family Platacidae　ツバメウオ科

196. *Platax pinnatus* (Linné) ツバメウオ　S

Family Chaetodontidae　チヨウチヨウウオ科

197. *Chaetodon modestus* Temminck et Schlegel ゲンロクダイ　S
198. *Microcanthus strigatus* (Cuvier et Valenciennes) カゴカキダイ　S

Family Molidae　マンボウ科

199. *Mola mola* (Linne) マンボウ　T

Family Cirrhitidae　ゴンベイ科

200. *Cirrhitichthys aureus* (Temminck et Schlegel) オキゴンベイ　S

Family Ophicephalidae　カムルチー科

201. *Channa argus* (Canttor) カムルチー　S

Family Anabantidae　トウギヨ科

202. *Macropodus chinensis* (Bloch) チヨウセンブナ　S

Family Balistidae　モンガラカワハギ科

203. *Balistes niger* Mungo Park モンガラカワハギ　S
204. *Canthidermis rotundatus* (Procé) アミモンガラ　+S

Family Monacanthidae　カワハギ科

205. *Monacanthus cirrhifer* Temminck et Schlegel カワハギ　+S
206. *Cantherinus modestus* (Günther) ウマズラハギ　+S
207. *Cantherinus tessellatus* (Günther) サラサハギ　S
208. *Rudarius ercodes* Jordan et Fowler センマイハギ　S
209. *Osbeckia scripta* (Osbeck) ソウシハギ　S

Family Hepatidae　ニザダイ科

210. *Hepatus triostegus* (Linné) シマハギ　S

Family Siganidae　アイゴ科

211. *Siganus fuscescens* (Houttuyn) アイゴ　+S

Family Ostraciidae　ハコフグ科

212. *Ostracion immaculatum* Temminck et Schlegel ハコフグ　S
213. *Tetrosomus gibbosus* Linné ラクダハコフグ　S
214. *Lactoria diaphana* (Bloch et Schneider) ウミスズメ　S
215. *Aracana aculeata* (Houttuyn) イトマキフグ　S

Family Tetraodontidae　マフグ科

216. *Lagocephalus sceleratus* (Forster) セソニソフグ　S

217. *Lagocephalus lunaris* (Bloch et Schneider) サバフグ S
218. *Fugu stictonotus* (Temminck et Schlegel) ゴマフグ T
219. *Fugu rubripes* (Temminck et Schlegel) トラフグ S
220. *Fugu pardalis* (Temminck et Schlegel) ヒガンフグ T
221. *Fugu vermicnlaris vermicularis* (Temminck et Schlegel) シヨウサイフグ +S
222. *Fugu vermicularis porphyreus* (Temminck et Schlegel) マフグ +S
223. *Fngu poecilonotus* (Temminck et Schlegel) コモンフグ T
224. *Fugu niphobles* (Jordan et Snyder) クサフグ S
225. *Boesemanichthys firmamentum* (Temminck et Schlegel) ホシフグ S

Family Diadontidae ハリセンボン科

226. *Diodon holacanthus* Linné ハリセンボン +S
227. *Chilomycterus affinis* Günther イシガキフグ S

Family Scorpaenidae カ サ ゴ 科

228. *Sebastes owstoni* (Jordan et Thompson) ハツメ N
229. *Sebastes inermis* (Cuvier et Valenciennes) メバル +S
230. *Sebastes joyneri* (Günther) トゴツトメバル N
231. *Sebastes thompsoni* Jordan et Hubbs ツヅノメバチメ (ウスメバル) N
232. *Sebastes steindachneri* (Hilgendorf) ヤナギノマイ N
233. *Sebastes nivosus* (Hilgendorf) ゴマソイ N
234. *Sebastes vulpes* (Steindachner et Döderlein) キツネメバル T
235. *Sebastes schlegeli* (Hilgendorf) クロソイ T
236. *Sebastes trivittatus* (Hilgendorf) シマソイ N
237. *Sebastes oblongus* (Günther) タケノコメバル +S
238. *Sebastes hubbsi* (Matsubara) ヨロイメバル S
239. *Sebastes pachycephalus* (Temminck et Schlegel) ムラソイ T
240. *Sebastes matsubarae* (Hilgendorf) アコウ S,D?

皆 川 (1937), 蒲 原 (1950), 黒 田 (1951): 標本逸出、松原 (1943) の記載と一致せず。*

241. *Sebastolobus macrochir* (Günther) キチヂ N
242. *Sebastiscus albofasciatus* (Lacépède) アヤメカサゴ S
243. *Sebastiscus marmoratus* (Cuvier et Valenciennes) カサゴ T
244. *Scorpaena izensis* Jordan et Starks イズカサゴ S.D
245. *Scorpaenopsis cirrhosa* (Thumberg) オニカサゴ S
246. *Scorpaenodes littoralis* (Tanaka) イソカサゴ S
247. *Pterois lunulata* Temminck et Schlegel ミノカサゴ +S
248. *Minous monodactylus* (Bloch et Schneider) ヒメオコゼ S
249. *Inimicus japonicus* (Cuvier et Valenciennes) オニオコゼ S
250. *Hypodytes rubripinnis* (Temminck et Schlegel) ハオコゼ S
251. *Erisphex pottii* (Steindachner) アブオコゼ S

Family Hexagrammidae アイナメ科

252. *Agrammus agrammus* (Temminck et Schlegel) クジメ T
253. *Pleurogrammus aznnus* Jordan et Metz ホツケ N
254. *Hexagrammos octogrammus* (Pallas) スジアイナメ N

* 皆川博 新潟縣の魚類について 郷土研究第一輯, 175—315. (出版年月日不明)

255. *Hexagrammos otakii* Jordan et Starks アイナメ　T

Family Cottidae　カジカ科

256. *Icelus spiniger* Gilbert コオリカジカ　N
257. *Triglops scepticus* Gilbert ニラミカジカ　N
258. *Triglops beani* Gilbert ホツキョクカジカ　N
259. *Ceratocottus namiyei* Jordan et Starks オニカジカ　N
260. *Cottus kazika* Jordan et Starks カマキリ　T
261. *Cottus pollux* (Günther) カジカ　N
262. *Dasycottus japonicus* Tanaka ガンコ　N
263. *Gymnocanthus pistilliger* (Pallas) ハゲカジカ　N
264. *Gymnocanthus ventralis* (Cuvier et Valenciennes) アイカジカ　N
265. *Gymnocanthus herzensteini* Jordan et Starks ツマグロカジカ　N
266. *Alcichthys alcicornis* (Herzenstein) ニジカジカ（ノロカジカ）　N
267. *Pseudoblennius percoides* Günther アナハゼ　T
268. *Pseudoblennius cottoides* (Richardson) アサヒアナハゼ　T
269. *Myoxocephalus jaok* (Cuvier et Valenciennes) オクカジカ　N
270. *Bero elegans* (Steindachner) ベロ　N
271. *Histiocottus bilobus* (Cuvier et Valenciennes) ホカケアナハゼ　N.D
272. *Blepsias draciscus* Jordan et Starks イソバテング　N.D
273. *Hemitripterus villosus* (Pallas) ケムシカジカ　D.N
274. *Vellitor centropomus* (Richandson) スイ　N

Family Platycephalidae　コチ科

275. *Platycephalus indicus* (Linné) コチ　S
276. *Wakiyus spinosus* (Temminnk et Schlegel) オニゴチ　S
277. *Suggrundus meerdervorti* (Bleeker) メゴチ　S
278. *Cocius crocodilus* (Tilesius) イネゴチ　S

Family Agonidae　トクビレ科

279. *Percis japonica* (Pallas) イヌゴチ　N.D
280. *Agonomalus proboscidalis* (Valenciennes) アツモリウオ　N.D
281. *Agonomalus jordani* Schmidt クマガイウオ　N.D
282. *Occa iburia* Jordan et Starks サブロウ　N.D
283. *Brachyopsis rostratus* (Tilesius) シチロウウオ　N.D
284. *Pallasina barbata* (Steindachner) ヤギウオ　N.D
285. *Pallasina eryngia* (Jordan et Richardson) ヒゲナガヤギウオ　N.D
286. *Podothecus sachi* (Jordan et Snyder) トクビレ　N.D
287. *Podothecus xystes* Snyder コシノトビクレ　N.D
288. *Podothecus accipiter* Jordan et Starks タカトクビレ　N.D
289. *Podothecus sturioides* Guichenot サメトクビレ　N.D
290. *Podothecus thompsoni* Jordan et Gilbert ヤセトクビレ　N.D
291. *Sarritor leptorhynchus* (Gilbert) テングトクビレ　N.D

Family Liparidae　クサウオ科

292. *Liparis agassizii* Putnum エゾクサウオ　N.D
293. *Liparis tanakae* (Gilbert et Burke) クサウオ　N.D

294. *Liparis tessellatus* (Gilbert et Burke) ビクニン N.D
295. *Crystallias matsushimae* Jordan et Snyder アバチヤン N.D
296. *Careproctus trachysoma* Gilbert et Burke ザラビクニン N.D
297. *Careproctus colletti* Gilbert アラスカビクニン N.D
298. *Careproctus sinensis* Gilbert et Burke セキチクビクニン N.D

Family Cyclopteridae ダンゴウオ科

299. *Cyclolumpus asperrimus* Tanaka コンペイトウ N
300. *Cyclopterichthys ventricosus* Pallas ホテイウオ N.D

Family Trigridae ホウボウ科

301. *Chelidonichthys kumu* (Lesson et Garnot) ホウボウ T
302. *Lepidotrigla güntheri* Hilgendorf カナドウ +S
303. *Lepidotrigla microptera* Günther カナガシラ T
304. *Lepidotrigla abyssalis* Jordan et Starks ソコカラガシラ T

Family Dactylopteridae セミホウボウ科

305. *Dactyloptena orientalis* (Cuvier et Valenciennes) セミホウボウ S
306. *Daicocus peterseni* (Nyström) ホシセミホウボウ S

Family Echeneidae コバンザメ科

307. *Leptecheneis naucrates* (Linné) コバンザメ +S
308. *Echeneis albescens* (Temminck et Schlegel) シロコバン S

Family Bothidae ヒラメ科

309. *Paralichthys olivaceus* (Temminck et Schlegel) ヒラメ T
310. *Pseudorhombus cinnamomeus* (Temminck et Schlegel) ガンゾウビラメ +S

Family Pleuronectidae カレイ科

311. *Atheresthes evermanni* Jordan et Starks アブラガレイ N
312. *Hippoglossus stenolepis* (Schmidt) オヒョウ N
313. *Hippoglossoides dubius* (Schmidt) アカガレイ N
314. *Hippoglossoides robustus* Gill et Townsend ドロガレイ N
315. *Cleisthenes pinetorum* Jordan et Starks ナリヒラガレイ N
316. *Cleisthenes herzensteini* (Schmidt) ソウハチ N
317. *Xystrias grigorjewi* (Herzenstein) ムシガレイ T
318. *Verasper variegatus* (Temminck et Schlegel) ホシガレイ +S
319. *Verasper moseri* (Jordan et Gilbert) マツカワ N
320. *Pleuronichthys cornutus* (Temminck et Schlegel) メイタガレイ T
321. *Limanda punctatissima* (Steindachner) スナガレイ N
322. *Limanda herzensteini* Jordan et Snyder マガレイ T
323. *Limanda yokohamae* (Günther) マコガレイ T
324. *Platichthys stellatus* (Pallas) ヌマガレイ N
325. *Kareius bicoloratus* (Basilewsky) イシガレイ T
326. *Clidoderma asperrimum* (Temminck et Schlegel) サメガレイ T
327. *Tanakius kitaharae* (Jordan et Starks) ヤナギムシガレイ N
328. *Microstomus achne* (Jordan et Starks) ババガレイ N
329. *Glyptocephalus stelleri* (Schmidt) ヒレグロ N

330. *Lepidopsetta bilineata* (Ayres) シュムシユガレイ N

Family Soleidae ササウシノシタ科

331. *Heteromycteris japonicus* (Temminck et Schlegel) ササウシノシタ S
332. *Aseraggodes kobensis* (Steindachner) トビササウシノシタ S
333. *Zebrias japonicus* (Bleeker) セトウシノシタ +S
334. *Zebrias zebrinus* (Temminck et Schlegel) シマウシノシタ +S

Family Cynoglossidae ウシノシタ科

335. *Rhinoplagusia japonica* (Temminck et Schlegel) クロウシノシタ T
336. *Areliscus interruptus* (Günther) ゲンコ +S
337. *Areliscus joyneri* (Günther) アカシタビラメ +S

Family Gbiidae ハゼ科

338. *Mogurnda obscura* (Temminck et Schlegel) ドンコ +S
339. *Luciogobius guttatus guttatus* Gill ミミズハゼ T
340. *Leucopsaron petersi* Hilgendorf シロウオ T
341. *Gobius pflaumi* Bleeker スジハゼ +S
342. *Gobius similis* (Gill) Lordan et Snyder ヨシノボリ S
343. *Gobius giurinus* Rutter ゴクラクハゼ +S
344. *Cryptocentrus filifer* (Cuvier et Valenciennes) イトヒキハゼ S
345. *Acanthogobius flavimanus* (Temminck et Schlegel) マハゼ T
346. *Pterogobius elapoides elapoides* (Günther) キヌバリ T
347. *Pterogobius zacalles* (Jordan et Snyder) リウグウハゼ T
348. *Chaenogobius annularis urotaenia* (Hilgendorf) ウキゴリ T
349. *Chaenogobius annularis annularis* (Gill) ビリンゴ T
350. *Caenogobius heptacanthus heptacanthus* (Hilgendorf) ニクハゼ S
351. *Chasmichthys dolichognathus dolichognathus* (Hilgendorf) アゴハゼ T
352. *Chasmichthys dolichognathus gulosus* (Guichenot) ドロメ +S
353. *Chaeturichthys hexanema* Bleeker アカハゼ（ダイナンハゼ） T
354. *Tridentiger obscurus obscurus* (Temminck et Schlegel) チチブ T
355. *Tridentiger trigonocephalus* (Gill) シマハゼ T

Family Parapercidae トラギス科

356. *Parapercis pulchella* (Temminck et Schlegel) トラギス S
357. *Neopercis multifasciata* (Döderlein) オキトラギス S
358. *Neopercis sexfasciata* (Temminck et Schlegel) クラカケトラギス S

Family Trichodontidae ハタハタ科

359. *Arctoscopus japonicus* (Steindachner) ハタハタ N

Family Uranoscopidae ミシマオコゼ科

360. *Uranoscopus japonicus* Houttuyn ミシマオコゼ +S
361. *Uranoscopus oligolepis* Bleeker ニラミオコゼ S
362. *Gnathaguns elongatus* (Temminck et Schlegel) アオミシマ T

Family Callionymidae ネズツボ科

363. *Callionymus lunatus* Temminck et Schlegel ネズツボ S
364. *Callionymus richardsoni* Bleeker ネズヨゴチ S

365. *Callionymus valenciennesi* Temminck et Schlegel ハタタテヌメリ T
366. *Callionymus beniteguri* Jordan et Snyder トビヌメリ T

Family Blenniidae ギ ン ポ 科

367. *Enneapterygius etheostoma* (Jordan et Snyder) ヘビギンポ S
368. *Zacalles bryope* Jordan et Snyder ユケギンポ S
369. *Blennius yatabei* Jordan et Snyder イソギンポ S
370. *Dasson elegans* (Steindachner) ナベカ S
371. *Salarias stellifer* (Jordan et Snyder) ホシギンポ S
372. *Enedrias nebulosus* (Temminck et Schlegel) ギンポ T
373. *Dictyosoma burgeri* Van der Hoeven ダイナンギンポ T
374. *Dinogunellus grigorjewi* (Herzenstein) ナガズカ N
375. *Lumpenus anguillaris* (Pallas) ウナギガジ N

Family Lycodidae ゲ ン ゲ 科

376. *Enchelyopus elongatus* (Kner) ナガガジ N.D
377. *Furcimanus nakamurae* Tanaka クロゲンゲ N.D
378. *Davidijordania poecilimon* (Jordan et Fowler) サラサガジ N.D
379. *Lycodes tanakae* Jordan et Thompson タナカゲンゲ N.D
380. *Allolepis holandi* Jordan et Hubbs ノロゲンゲ N.D
381. *Lycogramma zesta* (Jordan et Fowler) シロゲンゲ N.D?

田中 (1933) 皆川 (1937) : *Allolepis hollandi*

Family Brotulidae イ タ チ ウ オ 科

382. *Sirembo imberbis* (Temminck et Schlegel) ウミドジョウ S
383. *Hoplobrotula armata* (Temminck et Schlegel) ヨロイイタチウオ S
384. *Watasea sivicola* Jordan et Snyder シオイタチウオ S.D

Family Ammodytidae イ カ ナ ゴ 科

385. *Ammodytes personatus* Girard イカナゴ T

Family Bregmacerotidae サ イ ウ オ 科

386. *Bregmaceros japonicus* (Tanaka) サイウオ S

Family Gadidae タ ラ 科

387. *Gadus macrocephalus* Tilesius タラ +N.D
388. *Theragra chalcogramma* (Pallas) スケトウダラ +N.D
389. *Lotella phycis* (Temminck et Schlegel) イソアイナメ S
390. *Lotella maximowiczi* Herzenstein エゾイソアイナメ N
391. *Physiculus japonicus* Hilgendorf チゴダラ S.D

Family Lophiidae ア ン コ ウ 科

392. *Lophius litulon* (Jordan) キアンコウ T
393. *Lophiomus setigerus* (Vahl) アンコウ T

Family Antennaridae イ ザ リ ウ オ 科

394. *Pterophryne histrio* (Linné) ハナオコゼ S
395. *Antennarius tridens* (Temminck et Schlegel) イザリウオ S

Family Oncocephalidae ア カ グ ツ 科

396. *Halieutaea stellata* (Vahl) アカグツ S

Table 1. Comparison of fish distribution along the western coast of Honsyu.

Localities	Echigo and Sado		Toyama Bay		Sanin District		Japan	
Author	Honma 1952		Katayama 1940		Yanai 1950		Tanaka 1931	Habitats
Species	number	%	number	%	number	%	number	
N	96	68			45	26	141	Marine and Freshwater fishes
T	88	79			81	67	111	
S	212	28			225	29	747	
total	396				351		999	
N	86	64	78〔77〕	58	41	31	134	Marine fishes
T	70	80	62〔59〕	71	71	81	88	
S	204	28	271	37	217	30	736	
total	360		411		329		958	
N	10				4		7	Freshwater fishes
T	18				10		23	
S	8				8		11	
total	36				22		41	

The indication used in this list is as follows;

% ····· Percentage of local species, with whole Japanese fauna

N ····· Northern Japan form

+N ····· Form which extend their range southward beyond the northern Japan

S ····· Southern Japan form

+S ····· Form which extend their range northward beyond the sonthern Japan

T ····· Form which occurring throughout Japan

D ····· Deep sea fish

? ····· Fishes, their occurrence are doubtful

IV, 一般的考察

本目錄並びに本州西海岸の諸地方の目錄から魚類分布の比較表を作つて見た（Table. 1)。これ等の資料から考察してみるに、

1. 新潟縣の北日本系魚類が頗る多く今回は皆川（1937）の記載した47種のほぼ2倍である96種が報告された。この事は從來調査不充分であつた佐渡、粟島沖合の冬季底曳漁獲物を吟味した結果によるものである。これを特徴すける魚類は潜在性リマン海流の侵出を物語つており大約して次の諸科に屬している。

Chimaeridae, Scorpaenidae, Cottidae, Agonidae, Liparidae, Cyclopteridae, Lycodidae, Pleuronectidae, Gadidae etc.

2. 北日本系の魚類が本州西海岸を南下するに從いその種數を漸減していく事が表中にみられる。また山陰と新潟縣の南日本系魚類は、その種數が殆んど相異していない。これは夏期に佐渡沿岸並びに越後沿岸に極く接近して北上する對馬暖流の影響と思われる。但し Percomorphi に屬す多數の魚類を始め次の諸科に含まれる魚類は、僅かの種類が分布しているに過ぎない。

Labridae, Pomacentridae, Hepatidae, Balistidae, Ostraciidae, Tetraodontidae, Gobiidae etc.

3. 富山灣が魚類相に惠まれ熱帶產魚類をも產する事は從來より注目されていた。これは他の海棲動物についても言える事であつて、黑田・菊池（1933）の所說の如くその主要因を富山灣の地形と海流に求める事ができる。寒帶產魚類として富山灣の深海底より松原喜代松博士とその共同研究者並びに片山正夫教授等によつて、最近次々と報告された Cottidae や Lycodidae の新種・稀種は、現在迄に佐渡・粟島沖からは一匹も採捕されていない。

4. 新潟縣の海產魚類分布は、田中茂穗博士（1936）の所謂‘中日本區’に屬する事は言う迄もないが、これを南北に分つべき境界線を見出す事ができず北海道南部の魚類相と類似点が多い。北日本系魚類が周年棲息し、且多產する區域を‘佐渡海峽’と佐渡及び粟島沖の 180 尋以深に求める事ができる。

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Résumé

1. Ecnigo province and Sado Island are situated on the northwestern coast of Honsyu, but the coast line of the province is rather long but monotonous linear type.

2. In this catalogue the writer has recognized 396 species obtained from Echigo province and Sado Island. Out of them 360 species were marine fishes, including 86 of northern Japan, 204 of southeru Japan and 70 occurring throughout Japan. While 36 species were freshwater fishes, 10 of northern, 8 of southern forms and 18 occurring throughout Japan.

3. Some new remarcable and rare species, which obtained from Toyama Bay, recently, and reported by Prof. M. Katayama also by prof. Dr. K. Matsubara and his collaborators, have been not found in this area up to the present.

4. I believe there is no boundary line in this area, dividing northern or southern forms predominating region. The fauna resembles to that of southern part of Hokkaido. And many northern forms are dwelling through all season, in the depths more than 180 fm. of the channels between Sado and Awashima with main land.

Records of the "Mizu-uo-damashi" (New Japanese Name), *Anotopterus pharao*, and a Record of the "Etchiopia", *Brama raii*, from Near the Surface of the North-western Pacific*

Tokiharu ABE

(Tokaiku Suisan Kenkyujo, and Zool. Inst., Fac. Sci., Tokyo Univ.)

1. *Anotopterus pharao* ZUGMAYER from off Nemuro, Hokkaido

While examining the specimens of the Pacific saury, *Cololabis saira* (BREVOORT), taken by the stick-held dip net of the research vessel "Ibaragi-maru" at 42° 55′ N, 145° 42′ E (south of Nemuro, Hokkaido) on september 23, 1951, Mr. Masaya KOSAKA of the Tohoku University found among them an unusual elongate sharp-toothed fish which he sent to the present writer for identification through Mr. Ryuhei SATO of the same university. The writer provisionally identifies the fish as *Anotopterus pharao* ZUGMAYER** and wishes to give it a new Japanese name, "Mizu-uo-damashi", which means a fish resembling the "Mizu-uo", *Alepisaurus ferox* LOWE.

The specimen measures 671 mm in total length (from the tip of the conical non-ossified prolongation of the lower jaw to the posterior end of the caudal fin, the mouth being closed), 651 mm in fork length and 640 mm in standard lenght (S. L.). An almost intact Pacific saury measuring 315 mm in total length and weighing 95 gr (25 mon-me) is contained in the stomach. The following measurements of the specimen of *A. pharao* are expressed in hundredths of S. L.:

	Ratio
Length of head (from tip of conical non-ossified prolongation of lower jaw to vertical through posterior end of opercular flap) (H. L.[1]) 25.2	to S. L. 1 : 3.98
Length of head (from tip of upper jaw to vertical through posterior end of opercular flap) (H. L.[2]) 23.8	to S. L. 1 : 4.21
Greatest depth of body (at 40 mm behind ventral fin) 7.0	to S. L. 1 : 14.38
Greatest depth of body after removal of stomach contents (at posterior end of opercular flap) (D. B.) . . . . . *ca.* 6.1	to S. L. *ca.* 1 : 16.41
Greatest width of body (at 40 mm behind ventral fin) 4.1	to S. L. 1 : 24.62
Greatest width of body after removal of stomach contents (halfway between ventral and anal fins) . . . . . *ca.* 3.6	to S. L. *ca.* 1 : 27.83

* 東海區水產研究所業績B第88號

** The number and direction of teeth, the relative height of caudal peduncle, the relative size of eye, the relative size of the non-ossified projection of the lower jaw, *etc.* of the present specimen seem to differ from those of *Anotopterus pharao* ZUGMAYER and *A. antarcticus* NYBELIN. The specimen seems also to differ in the direction of the teeth of lower jaw from *A. vorax* (REGAN) of which only a skull of 150 mm long and a dentary were taken in the trawl at 71° 22′ S, 16° 34′ W, at a depth of 1410 fathoms. *A. arcticus* NYBELIN, though described only of a head taken from the stomach of *Hippoglossus hippoglossus*, seems to resemble the present specimen more closely than do the other three forms mentioned above.

		Ratio
Least depth of caudal peduncle (at base of upper foremost rudimentary fin ray of caudal)	*ca.* 1.9	to D. B. *ca.* 1 : 3.25
Width of caudal peduncle (")	*ca.* 1.0	
Depth of caudal peduncle at base of last anal fin-ray	2.2	
Width of caudal peduncle at "	1.9	
Width of bony interorbital space	1.5	
Greatest width of head (at posterior end of cranium)	2.7	
Length of snout (from tip of upper jaw to vertical through anterior margin of eye)	14.1	to H. L.[1] 1 : 1.78 to H. L.[2] 1 : 1.68
Length of postocular space (measured parallel to logitudinal axis of body) (PO)	8.3	to H. L.[1] 1 : 3.04 to H. L.[2] 1 : 2.87
Diameter of eye (measured parallel to logitudinal axis of body) (E)	1.6	to H. L.[1] 1 . 16.10 to H. L.[2] 1 : 15.20 to SN 1 · 9.05 to PO 1 : 5.30
Depth of snout at anterior margin of eye	3.8	
Depth of lower jaw at "	*ca.* 1.7	
Length of conical non-ossified prolongation of lower jaw (from upper corner of insertion to tip)	1.6	to E 1 : 1
" (from lower corner of insetrion to tip)	1.1	to E 1 : 1.43
Distance between posterior end of opercular flap to anterior end of base of ventral fin	35.9	
Distance between posterior end of base of ventral fin to posterior end of vertebral column	39.8	
Distance between tip of conical non-ossified prolongation of lower jaw (tlj) and anterior end of base of pectoral fin	25.0	
Distance between tlj and anterior end of base of ventral fin	60.9	
Distance between tlj and anteriorend of base of anal fin	89.8	
Distance between tlj and anterior end of base of adipose fin (measured parallel to longitudinal axis of body)	91.1	
Distance between posterior end of base of pectoral fin and anterior end of base of ventral fin	33.8	
Distance between posterior end of base of ventral fin and anterior end of base of anal fin	26.9	
Distance detween posterior end of base of adipose fin and anterior end of base of upper foremost rudimentary caudal fin-ray	5.1	
Distance between posterior end of base of anal fin and anterior end of base of lower foremost rudimentary caudal fin-ray	3.3	
Length of base of pectoral fin	1.9	
Height of pectoral fin (at highest middle ray)	5.6	
Length of base of ventral fin	1.3	
Height of ventral fin (at highest middle ray)	4.2	

	Ratio	
Length of base of anal fin	6.6	
Length of last ray of anal fin	2.0	
Lenghth of base of adipose fin	2.5	
Height of adipose fin (from anterior end of base to postero-dorsal corner)	4.4	
Distance between posterior end of base of ventral fin and anterior end of vent	1.7	to E 1 : 0.91

The body is extremely elongate, compressed anteriorly and subcylindrical posteriorly. The upper and lower jaws are long; the former is compressed and curved dorsally at its anterior end; the latter is wider posteriorly than the former and bears at its tip a conical non-ossified projection which is compressed and triangular in shape. The dorsal and ventral contours of the trunk are nearly parallel to each other (after the removal of the stomach contents). The lateral line is composed of two whitish close-set parallel lines and pairs of blackish pores. The number of the pairs of the pores is 75 (counted from above and a little behind the dorsal corner of the gill-opening) on the left side, and 74 on the right; on the posterior half of the caudal deduncle the pores are seemingly lacking. Between the dorsal corner of the hyomandibular and the first pair of the pores mentioned above are 4 single pores on the left side, and 5 single pores on the right. The similar pores are also present just below the dorsal ridge of the cranium (8 or more in number), below the eye (about 4 in number) and in the longitudinal groove of the lower jaw (more than 8 in number). The nostrils are paired on each side of the snout, the anterior one being much smaller than the posterior; a low skinny flap is formed on the septum between the two nostrils. There are a pair of nearly horizontal cutaneus keels between the anteriormost bases of the caudal fin-rays above and below.

The dorsal fin is lacking; an adipose fin is well developed. A. 16. P. 14 on each side. V. 11 on each side. C. xiii/10 + 7/xiv. Branchiostegal rays 8 on the left side, 7 on the right. Gill-rakers are lacking. Gills are 4 in number.

The total number of vertebrae is 79 (counting the hindmost segment as 1) *; the number of the precaudals or caudals have not been counted because of the strong decalcification by formalin of the appendages of the vertebrae. The vent is situated below the 37th or 38th vertebra; the interhaemals are below the 62th to 70th vertebrae. The number of the interhaemals is 15; they are all short, becoming a little longer towards the posterior ones. The ribs, neural and haemal spines are extremely thin and long, resembling peices of threads. Imbedded near the surface of the dorsal part of the muscles of the trunk are similar bones which lie obliq' ely. From the posterior end of the cranium, and on either side of the mid-dorsal line, run a pair of cords each of which anteriorly contains thread-like cores. The cords seem to be interrupted at the base of the adipose fin.

The teeth, and more especially those on the palatines, are very remarkable in size,

* The present writer has counted the total number of vertebrae of a specimen of *Alepisaurus ferox* LOWE from the Riu Kiu Islands. The number of the vertebrae was only 49 (counting the hindmost segment as 1)

position and direction. On each palatine is a row of 5 blade-shaped teeth, all compressed and fixed at the base; they occupy a considerable part of the buccal cavicty; the posteriormost tooth alone of each row is vertical and the rest are bent forward. The penultimate tooth of each row is the longest. The teeth of the left and right palatines are on alternate places. Attached to the inner side of the left palatine are 2 soft blade-shaped movable teeth; the anterior one lies horizontally, directing its tip backwards, and its base is just below the 5th, namely, the hindmost fixed tooth; the posterior one is a little distance behind the 5th tooth and lies horizontally, directing its tip backwards. On the inner side of the right palatine lies a similar soft tooth at the base of the 5th fixed tooth directing its tip also backwards. The pocket receiving it is a little in advance of the anterior end of the 5th fixed tooth.

The teeth of the upper jaw are very small, more than 50 in number on each side, arranged in a single row. They are attached to the premaxillary.

The teeth of the lower jaw are much larger than the premaxillary teeth, but much smaller than the palatine teeth. Some of the anteriormost teeth of the lower jaw seem to be missing in the present specimen. There seems to be no immovable tooth near the tip of the lower jaw (*cf.* MAUL, 1946, p. 58, fig. 22.). Besides the 11 (on the left dentary) and 12 (on the right dentary) sharp canine-like teeth, which are all immovable, bent backwards and arranged in a row on each dentary (with the exception of the antepenultimate tooth and the one just interior to it), there are 3 (or, a little more) smaller teeth placed just in advance of the anteriormost tooth of the row just mentioned. These smaller teeth are also immovable (*cf.* MAUL, *loc. cit.*).

The color in formalin: The back is dark grey, with bluish and golden metalic tint; the sides and belly are pale; the branchiostegal membrane, the membrane between the two dentaries and the anterior part of the both jaws are blackish.

2. *Anotopterus pharao* ZUGMAYER and *Brama raii* (BLOCH) from off the eastern coast of Kamtchatka

In summer, 1937 (or 1936), Mr. Takao ISAHAYA (then of the Division of Survey, Taiheiyo Gyogyo Co., Hakodate, Hokkaido) found several unusual species of fishes taken by drift-nets for salmons off the eastern coast of Kamtchatka, and sent to the Zoological Institute, Faculty of Science, Tokyo Imperial University *, one specimen of each of these species for identification. Among the collection were a specimen of *Anotopterus pharao* ZUGMAYER** and another of *Brama raii* BLOCH)** which are here reported upon. The former (Cat. No. 38,999, Zool. Inst, Tokyo Univ.) (figs. 1 and 2) measures 893 mm in total length (from the most anteriorly projecting part of the head to the farthest tip of the caudal fin), 873 mm in fork length and 860 mm in standard length. The specimen is now on loan to Mr. Giles W. MEAD, Natural History Museum, Stranfod University, who is now comparing it with specimens of *Anotopterus* spp. from other seas. The

* The name has been changed to Tokyo University since the end of World War II.

** Identified provisionally.

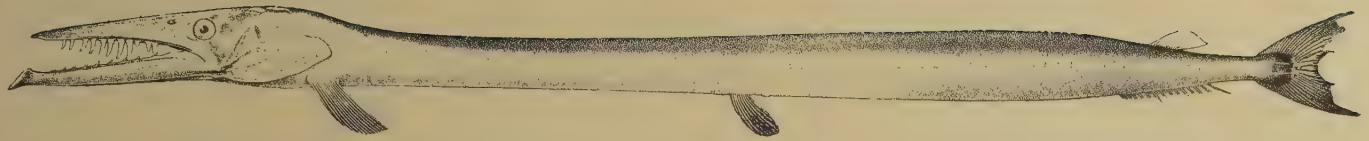

Fig. 1. *Anotopterus pharao* Zugmayer from off the eastern coast of Kamtchatka (Cat. No. 38,999, Zool. Inst., Tokyo Univ.). Total length 893 mm. Drawn by M. Shirao

Fig. 2. Head of the specimen depicted in fig 1. Drawn by M. Shirao.

present writer wishes to leave the more detailed study of this fine specimen from Kamtchatka in his hands, because he seems to have been much more interested in *Anotopterus* than the present writer and because it was Mr. MEAD who has expedited the writing of the present writer about this specimen and the other described above. It is the purpose of this short paper with figures to circulate it among the Japanese scientists and fishermen who may have opportunities of taking specimens of *Anotopterus* during their fishing of salmons near the Aleutian Islands in summer and fishing of the Pacific saury by stickheld dipnets off the northeastern coasts of the mainland of Japan and off the eastern and southeastern coasts of Hokkaido in autumn.

It may not be out of place here to mention about the frequent appearance of *Brama raii* near the surface off the eastern coast of Kamtchatka in summer, 1937 (or, 1936) (after Mr. ISAHAYA). During the years 1933—1941, and more especially during 1935–1937, this fish was also taken in considerable quantity from the Pacific coasts of Japan. Accord ing to Mr. Mitsugi YAMAGUCHI, Tô-to Suisan Co., Tokyo Central Wholesale Market, some 20,000 to 30,000 pounds of *Brama raii* were at times during the years shipped to the market mentioned just above. He saw them usually along with *Scombrops boops* (HOUTTUYN)* from Misaki. The fish dealers of the Market had to give a Japanese name to *Brama raii* for their purpose (although Japanese ichthyologists had called it "Hama-shimagatsuo"), and first called it "Kuro-mana" meaning a black *Stromateoides argenteus* (EUPHRASEN). But soon they changed the name to "Etchiopia" which means an Ethiopian fish, because the Japanese relations with Ethiopia became unusually cordial in those years, and because the black color of the fish was suggestive of the people of the tropics. The present writer also saw the fish at retailer's shops in Tokyo in summer of 1937 or' 1938)**. One day of the same year the late Prof. Naohide YATSU, Tokyo Imperial University, showed him a photograph of many individuals of *Brama raii* displayed at a retailer's shop in Tokyo and inquired about the fish. As he was always interested in learning about every animal he observed around him, the present writer thinks that it was for the first time tha tthe late Prof. YATSU saw *Brama raii* in retailer's shop in Tokyo where he lived for many years.

Since 1942, *Brama raii* has appeared very rarely at Tokyo Central Wholesaee Market.

The specimen of *Barma raii* (Cat. No. 38,996, Zool. Inst., Tokyo Univ.) sent by Mr. ISAHAYA from Kamtchatka along with *Anotopterus pharao* measures 430 mm in total length and 380 mm in fork length. D. 34 (=iv+30) (the first 3 rays shorter than the 4th). A. 28 (=iii+25) (the fist 2 rays shorter than the 3rd). P. 19 (=ii+17) on each side. Branchiostegals 7 on eash side. Gill-rakers 6/1/12 on each side. Predorsal

* This fish is taken by hook and line. According to Mr. YAMAGUCHI, *Brama raii* at times bore a hook in the mouth. According to the Fisheries Experiment Station of Kanagawa Prefecture, Misaki, the fishing grounds of *Scombrops boops* are between off Jogashima and off south-western coast of Susaki, depth being 500 – 600 m, and the fishing grounds of *Brama raii* were between off Jogashima (called Okiyama) and Sagami Bay during 1936 – 1941, at depths of 300 – 400 m. The latter species is rarely taken now.

** The present writer has lost his diaries during the confusion just after the end of the recent war.

scales *ca.* 37; scales from the upper angle of gill-opening to the end of lateral line *ca.* 70. He observed this species often among the salmons taken by drift nets off the eastern coast of Kamtchatka, during summer, 1937 (or, 1936), whereas of *Anotopterus pharao* he saw only 6 or a little more individuals. In summer of the next year also he observed only a few individuals of the latter fish and hundreds of *Brama raii* from the same sea.

Acknowledgement

It is with pleasure that the present writer expresses here his cordial thanks to Mr. Giles W. MEAD mentioned above by name for his suggestions, advices and encouragement. The writer is also very grateful to Mr. Takao ISAHAYA mentioned above for his generosity and valuable information concerning the salmon fishery off the eastern coast of Kamtchatka during 1936–1940. Furthermore, it is the pleasing duty of the writer to acknowledge the debt he owes to Mr. Ryuhei SATO and Mr. Masaya KOSAKA mentioned above for the permission of dissecting the Japanese specimen of *Anotopterus phorao*, to Mr. Nobuo WATANABE, Section of Oceanography, Tokaiku Suisan Kenkyujo, for the information about the oceanographic conditions of the northwestern Pacific during 1932 – 1942, and to Mr. Mitsugi YAMAGUCHI mentioned above for the information concerning the shipment of *Brama raii* to Tokyo Wholesale Market, and to the Fisheries Experiment Station of Kanagawa Prefecture, Misaki, for the information concerning the fishing grounds near Misaki and in Sagami Sea of *Brama raii* and *Scombrops boops*.

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Additional Notes

After this paper went to press, the present writer received an old specimen of *Anotopterus pharao* on loan from Prof. Shin-ichi Sato, Faculty of Fisheries, Hokkaido Univ., Hakodate, Hokkaido, Japan. The specimen reached the writer in good order through kindness of Mr. Hideaki Takano, Tokaiku Suisan Kenkyujo, Mr. Masateru Anraku, Hokkaido Univ., and Mr. Noriaki Ogawa, Hokkaido Univ. The writer wishes to express here his sincere thanks to the four gentlemen mentioned above.

The specimen measures 900 mm in total length, 870 mm in fork length and 855 mm in standard length. The locality and the date of collecting are unknown. It is supposed that the specimen was taken near Hokkaido or from Kamtchatka. It seems to have been discolored probably because of the exposure to the sun-light; the body is pinkish, with metalic greenish tint, and the back is a little dark. But the large black blotch of the distal part of the pectoral fin and the smaller black blotch of the distal part of the ventral fin are very conspicuous. The upper lobe of the caudal fin (the lower lobe has been damaged), the lower part of the branchiostegal membrane, and the membrane between the dentaries are dark bown. Dorsal fin absent; adipose fin well developed. A. 14. P. *ca.* 15 on each side. V. 11 on each side.

The palatine teeth are mostly similar in number and shape to those of the specimen of Tohoku University described above. These teeth of the two specimens, however, differ in the following points: i) Of all the palatine teeth, the anteriormost one is that of the right side in the specimen of Hokkaido University whereas in the Tohoku University specimen the anteriormost palatine tooth is that of the left side. ii) In the former specimen the posteriormost 2 fixed teeth of the right palatine are directed to the left and the 2nd to 5th (excepting the 3rd which has been damaged) teeth of the left palatine are directed to the right, these teeth of either palatine crossing with those of the other palatine near their bases.

In Hokkaido University specimen there is only one horizontally lying, movable tooth on the inner side of the right palatine received in a pocket which is situated a little in advance of the posterior end of the base of the 5th fixed palatine tooth.

The premaxillary teeth are arranged in a row at irregular intervals, very small and more than 71 on each side. The anteriormost teeth are much smaller than the posterior ones. The dentary teeth are all fixed (with the exception of the anteriormost

movable tooth of the left dentary), directed backwards, and 15 in number on each dentary. The anterior tip of the upper jaw is bent downwards. The number of the pores of the lateral line is difficult to count because the anterior part of the body has been dried.

A sand lance, *Ammodytes personatus* GIRARD, of 210 mm total length and a very slender malma trout, *Salvelinus malma* (WALBAUM), of 253 mm total length are contained in the stomach. They are with severe wounds (as though cut by a sharp knife), and direct their heads towards the vent of the predatory *Anotopterus pharao*.

—— 雜　　錄 ——

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タネギンポ *Istiblennius tanegashimae* (JORDAN et STARKS) の匍匐など

熱帯性のギンポ科魚類で海水から出て陸上を匍匐するのがあることは古くから知られている。日本産のものではナベカ *Omobranchus elegans* (STEINDACHNER) 及びカエルウオ *Istiblennius enosimae* (JORDAN et SNYER)に關しては夫々難波正作氏及び内田惠太郎教授の報告がある(動物學雜誌, 1926, xxxviii, p. 321 及び 1927, xxxix, p. 98)。筆者は 1952 年 7 月下旬八丈島に行く機會を得、他の魚類と共にギンポ類を觀察することが出來た。そしてカエルウオと同屬のタネギンポの二、三の生態を觀察した。八丈島ではタネギンポが絕對多數を占め、いたる所の磯で見られるが、カエルウオは甚だ少く僅かに 1 尾が大きな潮溜の中の岩の表面に附着しているもの（恐らく微細な藻類であろう）を舐めるかの樣に食べているのを見たに過ぎない。このカエルウオに甲殻類を潰して與えてみたが見向きもしない。草食魚類と言われているが正しくその通りである。尙、カエルウオの幼魚 1 尾の標本になつていたものを東京都水産試驗場八丈島漁業現業場長菅野裕氏にいただいた。この標本は最初カエルウオでないと思つていたのであるが調べた結果幼魚であることが明らかとなつた。この事に關しては別の機會に述べることとし、この機會に菅野氏の御好意に對して深謝の意を表する次第である。

タネギンポの原記載に際して與えられた圖は雌によつたものと思われ、頭部正中線に皮褶が示されていない。雄が成長すればこの皮褶が表われてくることを古い液浸標本で觀察していたが八丈島でこの事實を十分に確かめることができた。潮溜の中で雌雄が互に接近し睦ましくしようとする狀態を見たが、單にそれだけでそれ以上のことは見られなかつた。7 月下旬では產卵期が既に終つている。そして大小の潮溜には殆んど必ずタネギンポが棲息していた。採集したもので最小のものは頭端から尾端まで 15mm である。斯樣な幼魚がしばしば直徑10cm位の大体圓形の淺い潮溜に 10 尾以上もがいるのを見たが、潮溜は黑い岩の窪みであり、それに真夏の太陽が照りつけているのであるが、よく生きておれるものだと不思議に思う以外はない。この幼魚が中々捕えにくく手や小さい網などでは殆んで逃げられてしまう。結局小さなシヤーレで水と一緒に靜かに掬うのが最も能率がよかつた。逃げる時には乾いた岩の上をも跳ねながら他の潮溜か海かへ行こうとするのである。机の上で試みて見たが、全長 15mm 位の幼魚が 1 回に約 20cm も跳ぶことが出來る。跳ねるのは内田教授がカエルウオで觀察された如く、体の後半部を一側に強く曲げ、急に伸ばして他側に曲げる時に得る力で前方へ跳ねるのである。

個々の成体が水から勝手に出歩くのは見られなかつたが、集團をなして滑かな岩の上を匍匐するのは中々見物であつた。集團をなしてわざわざ水を出るのは何の目的であるか見當がつかない。この集團匍匐を見たのは薄日が洩れる日であつたが、晴天の時でも同樣なことがあると思われる。集團は人を容易に近づけない柄の長さ 2m 位のタモ網を使用しても捕えることは困難である。集團匍匐する場合は海水から殆んど垂直な岩をも之に附着しながら攀登つて集るのである。体をくの字形に曲げ之を伸ばしては上へ上へと這つて行く（くの字形に体の後半を右側に曲げることが多く、逆に左側に曲げる場合は極めて少なかつたが、之はタネギンポにもともと斯樣な習性があるのか、或は光線との關係によるのか、或は岩に取付く際に体が海面となす角度が人間が見ていること等のために何等かの制限を受けるから起るのか等考えて見たがよくわからなかつた)。適當な所に登つてしまうと方向をかえて頭を水の方に向けている。不思議なことに登攀の途中や靜止している時に相當激しい浪が打ちつけても決して岩から離れないことである。ハゼ類やウバウオ類等であれば腹鰭が吸盤の用をなすが、タネギンポの腹側には何等吸着の機關はない。ギンポ類の *Andamia* 屬では下唇のすぐ後方に吸盤が發達しているが、この屬に近い *Istiblennius* には吸盤らしいものは全くない。幼魚をガラス器に入れて置いた所、トビハゼが腹鰭の吸盤で水面に直角に附着し尾部を水中に沒して靜止していることがあるが、之と全く同じ形で靜止しているのを見た。体の粘液のみでは到底打ちよせる浪には堪え得ないから、口部で吸着するか、口部、胸鰭、腹鰭の間をどうにかして吸着するのだろうと思う。タネギンポの集團に人間が近寄つて行くとぞろぞろ這いながら、場合によつては半ば跳びながら逃げて行き、逃げる場所がなくなると始めて海中に飛込む。しばらくたつとまた這い上つて行くのである。

八丈島の人達はタネギンポのことをケーロメ（カエルメの訛り）と呼んでいる。メは眼ではなく、その他の魚や多くの動物の呼名にも使用されている接尾語である。實際はケーロメはタネギンポのみを指すのではなく、カエルウオも含めての呼名であろうが、八丈島に極めて近緣の之等のギンポ類が少くとも 2 種存在することを八丈島の人達がどれ位知つているかは確めないでしまつた。（冨山一郎）

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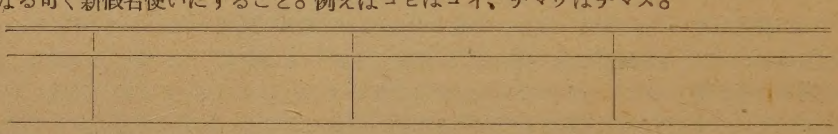

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(All communications and publications should be addressed to the publishing office)